AVIATION

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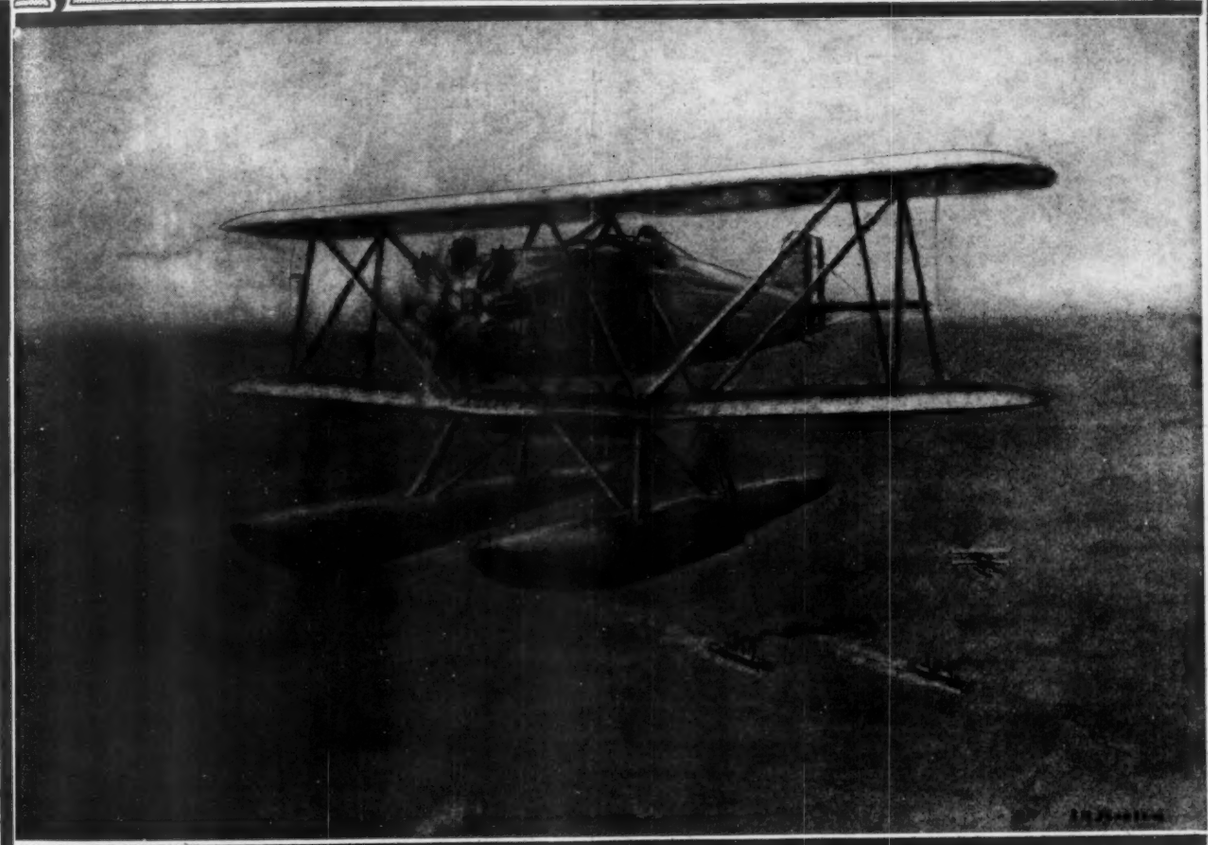

Aircraft Maneuvers in the Pacific

VOLUME XVIII

NUMBER 18

SPECIAL FEATURES

THE ELIAS MAILPLANE

THE ECONOMY OF AIR COOLING

STABILITY AND CONTROLLABILITY OF AIRPLANES

GARDNER PUBLISHING CO., Inc.
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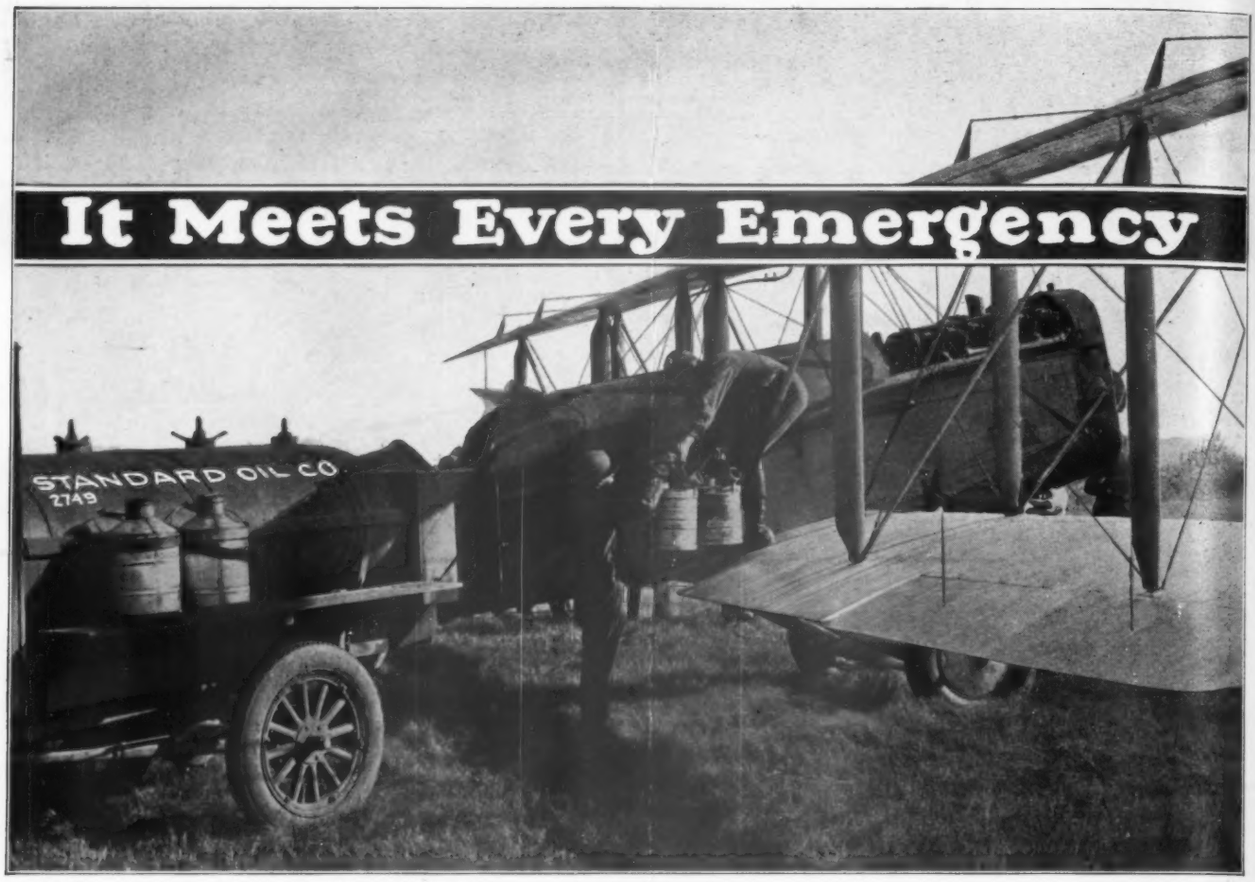

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MAY 4, 1925

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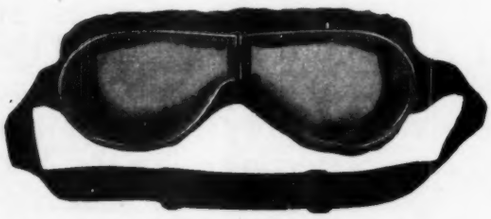

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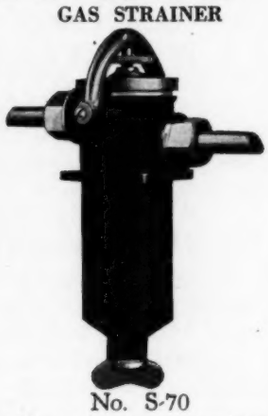

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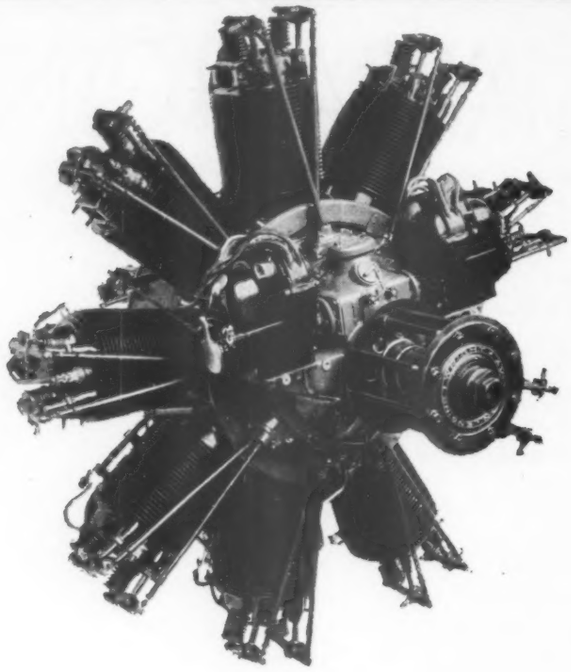

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Merchandise versus Passengers

EUROPE started its aerial transportation lines shortly after the war and laid its plans with a view of the transportation of passengers rather than of mail and express. Although there has been a gradual realization of the value of freight traffic and remarkable increase in the volume carried, Europe still lays its emphasis on the carrying of passengers. In America, as in Europe immediately after the war, proposed air lines were usually based on the carrying of passengers as the main source of revenue. However, the Air Mail with its wonderful results and possibilities has turned our thoughts toward the transportation of freight. With the exception of the Aeromarine Airways, none of the proposed passenger lines were operated regularly.

It is now quite generally agreed in this country that an air line should be based primarily on mail and express and not on the carrying of passengers. Freight transportation is considered as a preliminary step to passenger carrying which should be undertaken only when the service is well established.

The European emphasis on passengers and the American emphasis on merchandise is bound to develop rather different types of equipment and flying. The European air liners carry from eight to twelve passengers, which with baggage comes to 1500 or 2000 lb. of useful load; whereas the present mail-planes carry only 500 lb. and the new ships will have a capacity of only 1000 lb. Simple calculation will show that mail and express are better revenue producers per pound than are passengers but that on the same run there are potentially, at least, more poundage of passengers than of mail available.

The main difference between the two continents will be due, however, to the questions which concern safety. A freight ship may be so designed that the pilot is safe even in case of a serious crash, and in an emergency he can always use his parachute. The pilot of a passenger plane cannot take any such chances; the passengers cannot be protected by constructional features except to a very limited extent and they cannot be made to use parachutes. Besides, a crash on a passenger line has a much more serious effect on the traffic than a crash on a freight line.

As a result of our freight carrying theory we have been able to develop the art of night flying to an extent unknown on the foreign passenger lines. Europe, however, with its larger loads was forced, at the outset, to use twin-engined machines and, due to the need for safety, has continued into the development of the multi-engined machine because of its greater reliability.

The Air Mail with its smaller ship has relied upon extreme maneuverability, while the European designer is struggling with the more baffling problem of a greater aerodynamic safety; that is, eliminating the stall and attendant phenomena while still maintaining maneuverability. He also encounters the problem of a slow landing and a high normal speed. Devices such as flaps and slotted wings will receive much more attention in countries where transportation of passengers is the mainstay of the business.

Our Air Mail pilots excel in countour flying, and, with a few exceptions, find their way by landmarks on the ground rather than by pure navigation. Contour flying in the large European air transport planes is much more difficult, if not impossible, and we can expect the larger ships abroad to carry a navigator and to be less dependent on a view of the ground.

The primary problem of the European airlines is safety for their passengers while the primary problem of American merchandise lines is efficiency of schedule performance and speed, with less emphasis on pounds of useful load per horsepower. It will be interesting to note whether the divergent tendencies which already exist will continue.

Airways and Instruments

DURING the war, pilots were trained to fly for military purposes "by feel." The use of instruments was left well in the background. Most of the French primary training machines were practically devoid of instruments. The majority of pilots who continued to fly after the war considered instruments almost unnecessary. Anyone who felt the need of them was looked on as a "mechanical" pilot.

The gradual growth of commercial aviation is bringing about a change in this attitude. Pilots who owned their own ships soon learned that the use of instruments relating to the power plant would increase profits if their indications were heeded. The day of the pilot who estimated the r.p.m. of his engine and guessed at its water temperature and oil pressure is passing. Careful pilots now operate their engines at a predetermined speed and are at all times cognizant of the operation of all power plant accessories.

Contour flying demands the highest skill of piloting but it is essentially unsafe. Many pilots fly under the clouds on cross-country trips today because they were brought up to distrust and look down on instruments. Flight indicators, compasses and other navigation aids have only recently been brought to relative perfection. Many pilots are unaware of their advantages.

It is becoming a common thing for a ship equipped with a modern gyroscopic flight indicator and earth inductor compass, to make a cross-country flight of several hundred miles, most of the time out of sight of land. When traffic on the airways becomes heavy, local or Federal regulations will appear, compelling aircraft to observe a certain minimum altitude, very likely in the neighborhood of 2,000 ft. Observance of this restriction will require a greater amount of flying by instrument.

The day of the pilot who prides himself on his disregard of aeronautical instruments will soon pass, and flying by instrument indications will become a required necessity on all well conducted airlines.

The Elias Mailplane

Description of the Third Machine Built in Response to the Post Office Department's Proposal for Bids

The latest production of the Aircraft Department of G. Elias and Bro. is the M1 mailplane to the designs of M. Stupar, the chief engineer. This machine was designed with the requirements of mail service in mind and every effort was made to incorporate all the desirable features. Among these may be mentioned the divided axle, the accessible mail compartment and ease of engine maintenance. The test pilot reported that the machine was very controllable and that it could be flown hands off at all speeds from 100 to 110 mi./hr.

It is a single bay, wire braced biplane. There is no center section, the two upper panels being supported at the center by two inverted vee pairs of struts. There are two struts leading from the upper longerons to the lower wings above the landing gears on each side of the fuselage. Ailerons are fitted to both upper and lower wings. Control horns are used on the lower pair only, the upper one being controlled by a strut. The ailerons are not balanced. The wings are wood construction with box spars. The ribs have a plywood web with solid cap strips and vertical members. The fittings are low carbon steel plates with the bolts on the neutral axis of the spar. The internal drag bracing is double and of tie rod construction.

Fuselage

The fuselage is built up of welded steel tubing and struts with tierod bracing. The mail compartment is at the center of gravity and sheathed with 1/16 in. duralumin plates. This construction renders the compartment fireproof and able to stand up under hard service. The cover is hinged on the right side and fastened with two clasps and a cylinder lock similar to those on trunks. A shelf and rings are provided to take care of small or special loads. The fuselage is covered with cloth from the engine cowling aft. Special care was given the pilot's cockpit. The instrument board is divided and made of aluminum with the lettering etched in. The seat is adjustable on the ground and arranged for a seat type parachute. The wind shield is quite large and has an alcove in it for the magnetic compass.

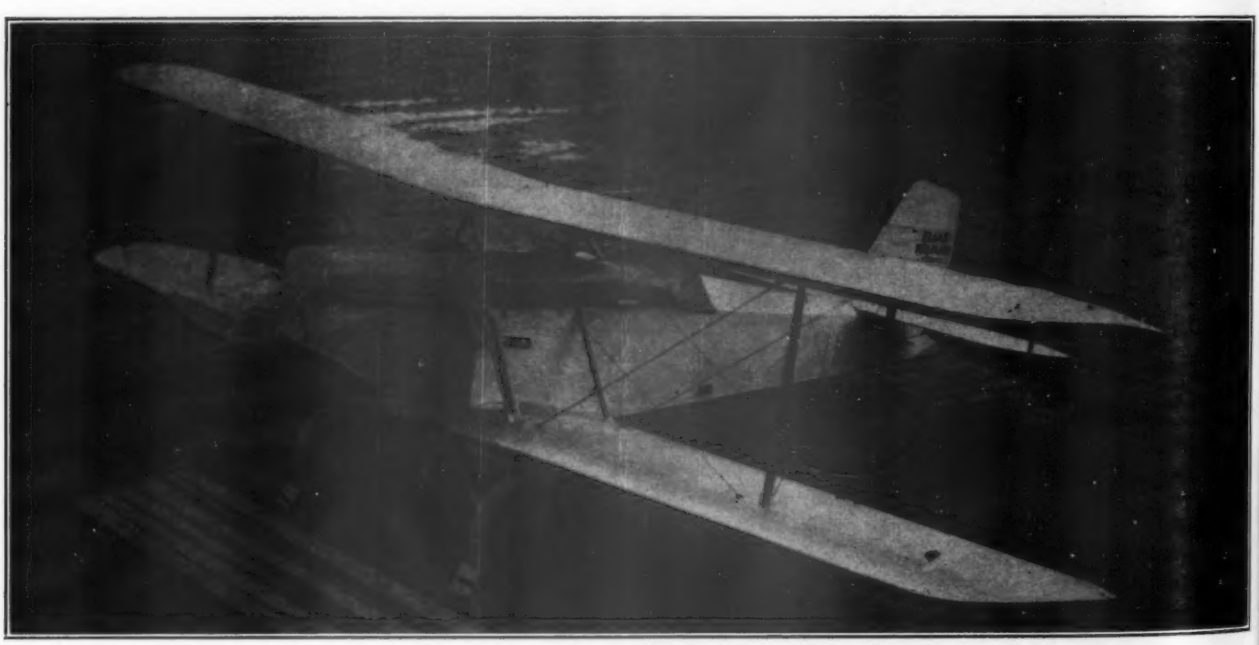
The landing gear is in two parts and in general arrangement similar to those on twin engined bombers. This construction gives a track of eight feet for the wheels. Regular rubber shock absorber cord is used and is located at the wheel hubs with a streamline housing. There are three struts to each wheel, one vertical attached to landing spar, one leading to the rear spar and one running from the lower longeron and carrying the wheel.

Empennage

The empennage is of conventional arrangement with the stabilizer braced only on the lower side with one strut. The elevators are of wooden construction and mounted on a single steel torque tube. The stabilizer is adjustable in the air. The wheel in the pilot's cockpit is calibrated so that the pilot can always tell the incidence of the tail. The rudder is balanced. The rudder and fin assembly can be removed by taking out three bolts. The stabilizer has an inverted camber, being flat on the upper surface.

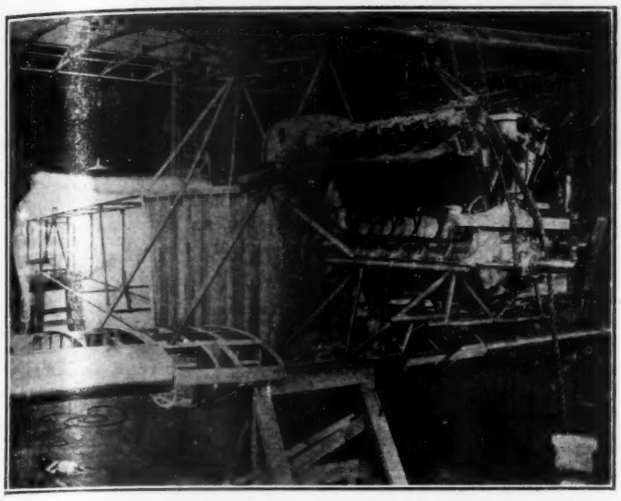
Ball bearings are used throughout in the control system. There are four pulleys for the ailerons and two for the rudder. The aileron control wires are lead through the wing to two pulleys near the control horns. Inspection windows are provided for them. The elevator and rudder controls are carried outside the fuselage from aft of the pilot's seat. The rudder bar is adjustable fore and aft.

The engine is the standard Liberty XII used by the Post Office Department. The engine mounting is entirely of welded steel tubing. The removal of six bolts and the engine controls permits the entire engine assembly to be removed. Steps are provided for the use of mechanics working on the engine. The cowling is self supporting, being riveted to square steel tubing. The entire cowling may be removed by taking out six bolts and a few quick detachable pins of



One half front view of the Elias M1, showing the clean design and the accessible mail compartment and engine

generous size. The propeller is fitted with a streamlined hub running easily into the cowling lines. The fire wall behind the engine is bumped out to allow room behind the accessories. This fire wall is double and is lined with 3/8 in. asbestos and an air space. This construction permits it to insulate over 1200 deg. F. of heat.



The uncovered wings and fuselage of the Elias mailplane. The engine mounting details can be easily seen

The radiator is mounted under the fuselage in a free air position. The shutters were designed to offer the least possible resistance to the air when open. The radiator is in two sections. The main gasoline tanks are in the wing roots under the non-slip sidewalks. There are two and each one contains 40 gal. These tanks are droppable in flight. There is also a gravity tank holding 10 gal. used for starting and as a reserve. This tank is made of 1/8 in. material and is of crashproof construction. The device to disconnect the gasoline lines when the tanks are dropped has received considerable thought from the builders and is instantaneous in its action. The filler caps are quick releasable and the tanks may easily be filled from the ground. The gasoline control is on the instrument board and the pilot may use fuel from any one of the three tanks. The oil tank is mounted under the engine and is felt lined.

AIRPLANE CHARACTERISTICS

Length, overall	28 ft. 0 in.
Span, upper wing	40 ft. 0 in.
Span, lower wing	40 ft. 0 in.
Chord, upper wing	6 ft. 6 in.
Chord, lower wing	6 ft. 6 in.
Gap	6 ft. 0 in.
Stagger	0 in.
Airfoil (wing section)	Eiffel 385
Angle of incidence	—½ deg.
Sweepback	0 deg.
Dihedral, upper wing	1½ deg.
Dihedral, lower wing	1½ deg.
Area of wings, including ailerons	497 sq. ft.
Area of ailerons	40 sq. ft.
Area of tailplane	61 sq. ft.
Area of elevators	26 sq. ft.
Area of rudder	15 sq. ft.
Area of fin	20 sq. ft.
Track of wheels	8 ft. 0 in.
Weight empty	2857 lb.
Useful load	
Fuel and oil	610 lb.
Crew	200 lb.
Pay load (mail)	1000 lb.
	1810 lb.
Total weight	4667 lb.
Wing loading	9.39 lb./sq. ft.
Power loading	11.60 lb./hp.
Fuel capacity	90 gal.
Range	450 mi.
Maximum speed, full load	130 mi./hr.
Landing speed, full load	48 mi./hr.
Initial rate of climb	1100 ft./sec.
Service ceiling	1600 ft.

What is the Value of Speed?

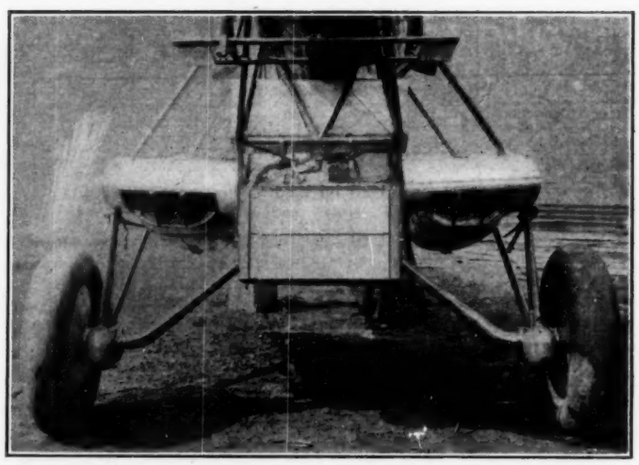
Editor, AVIATION:—

If an airplane can carry mail at the rate of 100 mi./hr. (which the U. S. Air Mail Service has demonstrated can be done) and if the best speed produced on a parallel railroad in the transmission of the same class of mail between two identical points, is 50 mi./hr. (the approximate average speed of the Twentieth Century Limited), what, if any, is the value of the coefficient "2"?

To put the problem in a slightly different manner: The United States Air Mail Service operates between New York and Chicago in about 10 hr. elapsed time. The corresponding time consumed by the fastest train carrying mail between the two cities is 20 hr. When the over-night schedule of the Air Mail is placed in effect, June first, mail deposited in either New York or Chicago in the late afternoon for dispatch by air will save one complete business day in the trip between the two cities. In other words one instead of two days will be taken. Here again, rather fortunately for the illustration, the speed by air is twice that by rail.

If the letter is posted to be delivered by railway mail the cost to the sender is two cents per ounce. If by air, the charge is eight. Then for twice the speed, a charge of four times the rail rate is made for air service.

Another example should be cited. To take the Reno, Nev.—San Francisco run, a distance of 244 mi. by rail short line and 190 mi. by air, it will be found that the best train time is about 10 hr. and the Air Mail schedule calls for 2 hr. This is a different situation from the New York—Chicago line. Here by train an entire day is consumed in the journey, or a night. By plane, however, it would be possible for mail written in the morning to be delivered at the other end of the line the same afternoon. For five times the speed by plane the eight cents per ounce rate is charged, amounting to four times the regular rail rate of two cents. In this instance if the air service were offered, leaving terminals in the middle of the day a complete business day would be saved, but if the letter were not ready for posting until late afternoon no saving would be effected by the air trip.



The landing gear and radiator construction of the Elias. The droppable tanks are shown in place

The overnight flight from Chicago to Cheyenne compares with an average of about 26 hr. by the fastest rail time. Here an entire business day is saved by air. But the ratio of time saved is still but 2, and the cost to the sender of mail is 4 times the regular rate, if the Air Mail is preferred.

Can it be said that a fair price for twice the speed of rail service is four times the rate of that service? Or perhaps more comprehensive a question would be: "What is the value of speed in transportation?"

THOMAS HART KENNEDY.

Stability and Controllability of Airplanes

Part V. Effect of Various Wing Arrangements

By B. V. KORVIN-KROUKOVSKY

Stability in Yaw can be secured by the use of vertical empennage area and by sweepback of the wings. The empennage acts in this case exactly as a weather vane. The large side area of the deep fuselages often used at present must be taken into consideration in estimating the effective fin area. The center of pressure on sides of the fuselage can be assumed in this connection to be at about 25 per cent of its length. The effect of sweepback on stability in yaw can be readily understood after an examination of Fig. 9. The wing on the side of the yaw has a larger angle of incidence and a thicker virtual airfoil section, and consequently experiences more drag, which tends to make the airplane head into the composite direction of motion. The stability in yaw, as well as the stability in roll, comes into play whenever there is a sideways component of velocity regardless of the position of the airplane or its direction. If in straight flight the machine is yawed, the stability in yaw will tend to return it to original direction. If, however, the machine flying straight begins to bank and side slip, the stability in yaw tends to turn in the direction of side slip. Similarly during the turn the stability in yaw causes the airplane to tighten the turn in the case of side slip, and to come out of the turn in the case of skidding. The fact that both stability in roll and stability in yaw depend for their action entirely on the side slip or the yaw is of extreme importance in the consideration of their combined action, which will be taken up later in this paper.

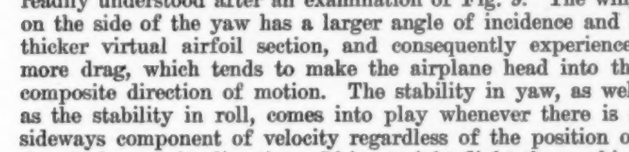


Fig. 9

As we explained in the treatment of longitudinal stability, we mean, under damping, the moment generated by the very fact of the motion and opposing this motion. In this respect the effect of damping is very similar to friction. It tends to stop any motion, whatever is the direction or nature of it. If it were not for damping, any oscillation of the airplane, be it pitching, rolling or yawing would keep on indefinitely. The heavier the damping the quicker the oscillations will die down. Let us now consider in detail how the damping in roll is produced.

Fig. 11 shows the front elevation of an airplane and the section of each wing taken at the same distance from the fuselage. Let us assume that the machine is flying at an air speed V and is rolling as shown by the arrows. The section of one wing will then have an upward velocity w, while the section of the other will have a downward velocity of the same magnitude. The resultant velocity of each section is obtained by adding geometrically the velocity vectors V and w. We will observe immediately that the effect of vertical velocity w is to diminish the angle of incidence of the wing moving upward and to increase the angle of incidence of the wing moving downward. This means that the lift of the wing moving downward will be increased, while that of the wing moving upward will be decreased. This inequality of lift of the two wings produces a moment resisting the rolling. If the direction of rolling should change, the distribution of lift will also change, with the result that the moment produced by the wings will be always opposed to the rolling. We call the reader's particular attention to the fact that change in the angles of incidence and the lift of the two wings occurred due to the angular velocity of the airplane and not due to any angle of the bank. The inequality of lift ceases to exist at the moment angular motion ceases whatever may be the position of the airplane at that moment.

Let us investigate how the damping in roll is affected by the proportions of the wings and by the angle of incidence. Assume each wing to be divided into an equal number of sections or wing elements and consider the action of one element as representative of the whole airplane. The damping moment due to this element is evidently proportional to its area, its distance from the center of gravity of the airplane, and to the change of its angle of incidence. The change of the angle of incidence is in turn proportional to the vertical velocity w of the element or for a given angular velocity to the distance of the element from the center of gravity. As the area of the element, as well as the distance from the center of gravity are proportional to the span of the wings we conclude that damping must be proportional to the third power of the span. The change in chord of the wing affects only its area, hence the damping must be directly proportional to the wing chord. Thus the damping is proportional to the chord times cube of the span, or we can say the *damping is proportional to the moment of inertia of wing area about the center line of the airplane.* Actually, airplanes of higher aspect ratio show quicker change of lift for the same change of the angle of incidence, and have therefore slightly higher damping than one would expect from the above considerations.

In order to analyze the effect of the angle of incidence on the damping we will recall that the total lift of the wings is essentially the same at any angle of incidence and is about equal to the weight of the airplane. As the speed changes the *lift coefficient* changes in inverse proportion to the square root of the speed, but the *lift* remains the same. We can estimate then, the intensity of damping at different speeds of flight by comparing the increment of lift on the wing element with the weight of the airplane, for the same angular velocity of roll. The lift coefficient for moderate angles of incidence is proportional to the angle, hence it will be sufficient for us to examine merely the change of the angle of incidence due to roll without bothering with the actual computation of the lift. It is evident from the above, that the ratio of increment of lift on the wing to its total lift, otherwise to the total weight of the machine, is proportional to the ratio of increment of the angle of incidence to the original angle—$\Delta\alpha/\alpha$ measured from the angle of zero lift. Let us consider a case of an airplane flying at speed of 100 mi./hr. and at the angle of incidence of 2 deg. rolling at such a rate that the change in the angle of incidence $\Delta\alpha$ is equal to one degree. The ratio $\Delta\alpha/\alpha$ is equal therefore to 1/2. Assume now that the same airplane is flying at the speed of 50 mi./hr. The vector V is now twice shorter. As we consider the airplane rolling at the same angular velocity, the vector w remains unchanged, which means that increment of the angle of incidence $\Delta\alpha$ is now equal to 2 deg. The angle of incidence α at half the original speed is four times the original angle or $\alpha = 8$ deg. The intensity of damping $\Delta\alpha/\alpha$ is equal now to 1/4, or only half of its value at 100 mi./hr. Thus we conclude that for variations of speed in normal flight the *damping varies directly* as the air speed. Speaking of the air speed in this case we assume it to be measured in terms of the landing speed. The pursuit machine flying at twice its landing speed will experience the same damping as a slow speed training ship of the same aspect ratio flying at twice its stalling speed. A more accurate definition is to say that the *damping varies in inverse proportion to the square root of the angle of incidence.*

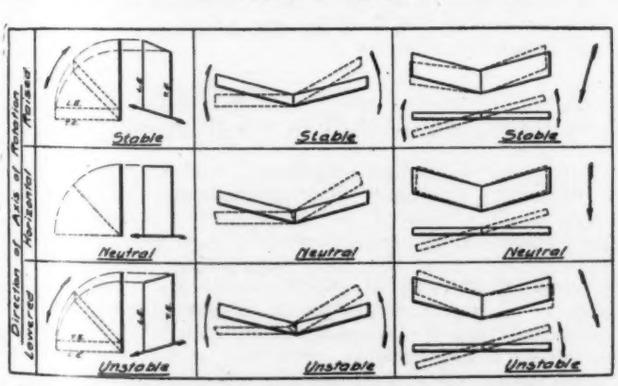
The assumption that the lift coefficient is proportional to the angle of incidence is valid only for the angles at which the lift coefficient does not exceed about three quarters of its maximum value, as can be seen in Fig. 12. As the stalling angle is approached the lift varies less and less for the same change in the angle, and consequently the damping becomes weaker and weaker. At the stalling angle there is practically no variation in lift for the small changes in the angle, consequently the damping becomes weaker and weaker. At the stalling angle there is practically no variation in lift for small changes in the angle, consequently there will be no damping and any accidental cause can make the airplane roll violently.

Autorotation

As the angle of incidence increases beyond the burble point (say to 20 or 30 deg.) we find that the lift coefficient curve changes its slope. In this region an increase of the angle of incidence results in a decrease of lift. Suppose now that the airplane shown in Fig. 11 was stalled until the angle of incidence is in neighborhood of 20 or 30 deg. As the roll starts, the effective angle of incidence of the downward moving wing increases, as was explained above, but in this case the increase brings about a loss of lift instead of the previous gain. The wing moving downward loses lift, while the one moving upward gains lift. Such a distribution of lift produces moment acting *in the direction of roll* instead of against it as before, which fact causes the roll to continue or even accelerate, instead of damping it. This phenomena of negative damping at the angles of incidence above stalling is known as *autorotation*, and is the basic cause of the tail spin.

Damping and autorotation can be readily demonstrated in the wind tunnel by mounting a model wing so that it can rotate freely about an axis parallel to the wind, as is shown in Fig. 13. If the model is set at a moderate angle of incidence say 8 deg., it can be made to spin freely by hand if there is no wind. When placed in the wind, however, it will stop any rotation very quickly because of the damping. If set just at the stalling angle it will rotate just as freely with wind on or off, but will not start rotation by itself, nor will it accelerate. If set at an angle of incidence sufficently above stalling it will rotate quickly by itself with the least provocation. The velocity of rotation in this case was found to depend on the wind speed and the span of this wing, being directly proportional to the wind speed and inversely to the span.

So far we have spoken only about damping in roll. As the motions of an airplane to be considered in connection with lateral stability include side slip and yaw, there must be also some damping in these motions as well. This damping is generated by the air pressure on the vertical fin surfaces, including under this general term actual fins, as well as the side areas of the fuselage landing gear, struts, etc. The



Effect of Inclination of Axis of Rotation on Stability in Roll in Cases of Vertical Fin, Dihedral & Sweepback.

Fig. 10

nature of damping in yaw and in side slip is practically the same as in the case of the roll: the vector of side slip velocity added geometrically to the vector of forward velocity makes the resultant meet the surface at an angle of incidence, and hence causes the generation of pressure on that surface. This pressure is always of such direction as to oppose the movement. As in roll, the damping in yaw and in side slip is directly proportional to the speed of flight, but in this case it is the actual speed in miles per hour that counts, and not the speed range. The damping in side slip and yaw evidently does not depend on the angle of incidence, and is equally effective for the same speed above and below the stalling angle. This property makes the damping in yaw very valuable for the prevention of tail spin, as we will show in more detail later.

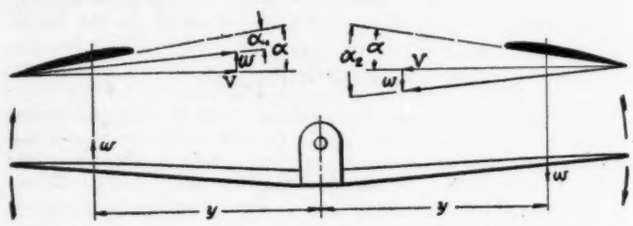


Fig. 11

Under the subject of control action, we will consider the immediate effect of the ailerons and rudder on the airplane, without going very deeply, however, into its behavior. The general behavior of the airplane under the action of stabilizing and controlling moments we will consider later.

The ailerons are usually conceded to control the rolling motions of the airplane, and in this connection the attention is usually concentrated on their lift, while the effect of their drag is much too often neglected. This is particularly the case in wind tunnel experimenting where the rolling moments are measured with different aileron settings, while the model is restricted from either pitching or yawing. In the actual flight of an airplane the yaw usually causes roll and vice versa, and the drag of the ailerons as affecting yaw and indirectly roll cannot be neglected. We will consider separately therefore the *lift effect* and the *drag effect* of the ailerons.

Purpose of Ailerons

A lowered aileron causes increase of lift of the wing by virtually changing its camber, as well as by increasing its angle of incidence. Similarly, a raised aileron causes a decrease in lift. When one aileron is lowered and the other one is raised, the lift of one wing is increased and the other one decreased, and consequently a moment is generated tending to roll the airplane in the direction of the raised aileron. The roll of the airplane is always accompanied and resisted by the *damping in roll*, which is usually very powerful on account of the large span and area of the wings, particularly if the airplane is flying at high speed. Indeed, many machines barely respond to the ailerons in horizontal flight with the throttle wide open. We explained in connection with longitudinal control, that elevators must be designed to govern the distribution of the air pressure over the stabilizer, rather than to take large pressures on themselves. This principle is so much more important in application to the ailerons, which generally are liable to be stiff. The rules laid down for the elevator design apply largely to the ailerons as well. The first rule is to eliminate overhangs of any description and to have all of the aileron area behind the wing, and if possible not too close to the tip. Rounded wing tips or tips with negative rake are most efficient, while the raked tips are least efficient because of the formation of small areas of high pressure at the tips near the trailing edge. The reader must realize that it is not large controlling moment that is needed but rather the elimination of damping. Such an elimination is virtually caused by long and narrow ailerons affecting a larger part of the wing area. When such ailerons are deflected they cause a change of pressure distribution on the wings which causes the machine to roll. The narrow chord of the ailerons is very important for the reduction of the pilot's efforts in view of the usually large area of the ailerons.

A very comprehensive wind tunnel investigation of aileron properties was made by the National Physical Laboratory in England and was described in the A.C.A. Rep. and Memo. Nos. 550 and 615. The tests included different shapes of wing tips, varying proportions of span and chord, and the effect of "wash-out." The investigation was confined to the lift effect of ailerons and their efficiency was judged by comparison of the moment required to operate the ailerons with the rolling moment of the machine. The conclusion reached in respect to the shape of the wing tips has already been mentioned. Regarding the span and the chord of the ailerons, it was found that the most efficient combination is obtained when the chord of the ailerons forms about 22 per cent of the wing chord, and the span of ailerons is equal to two thirds of the span of wings.

Special Ailerons

The ailerons with a wash-out of some 9 deg. were also tested and, although their efficiency was found to be slightly higher than the efficiency of straight ailerons, the difference was far from sufficient to explain their much more efficient action reported from flight tests. The practical efficiency of such ailerons is apparently due to their drag effect, which we are ready now to discuss.

In the majority of airplanes, the ailerons are so interconnected that one aileron moves up, while the other one moves down exactly the same amount. The aileron moved down causes immediately an increase of drag of that wing, while the one moved up through a small angle causes a reduction of the drag, and even at large angles gives less drag than the lowered one. The difference in drag, if not properly counteracted by the rudder, causes the airplane to yaw in the direction of the lowered aileron. This makes the wing with the raised aileron move faster than the other one and thereby increases its lift. At the same time an airplane, stable in roll, tends to respond to yaw by raising the wing on the side of the relative wind. Both of these secondary effects tend to roll the airplane in the direction opposite to one required by the "lift effect," and therefore detract from its effectiveness. This effect is particularly noticeable near stalling speed when the *lift effect* of the ailerons is very weak, while the *drag effect* is even more pronounced, being based on the relative change of velocity of two wings, and being less opposed by the damping in yaw. This phenomena is marked in the case of warping wings, when the effect of warp is found sometimes to give opposite action near the stalling speed.

Ailerons with wash-out are essentially equivalent to ordinary ailerons set initially at a negative angle, so as to equalize their drag, or better yet to give the raised aileron more drag

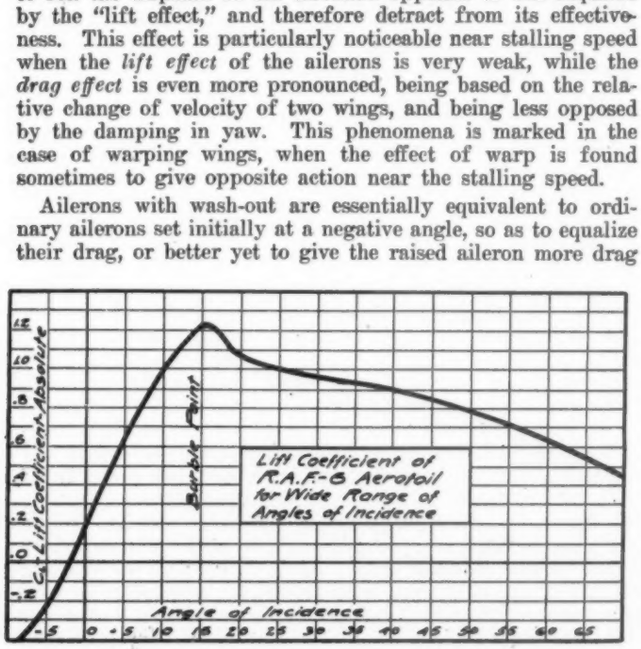

Cz Lift Coefficient Absolute
Stalling Point
Lift Coefficient of R.A.F-6 Aerofoil for Wide Range of Angles of Incidence
Angle of Incidence

Fig. 12

than the lowered one. Such ailerons make the machine yaw in the direction of the raised aileron, and consequently make the two secondary effects described above act *with the lift effect*, greatly increasing thus the response of the airplane to the aileron control. Flight experiments on an RE8 airplane were described in A.C.A. Rep. and Memo. No. 413. The machine was fitted with standard ailerons of 24 in. chord on 66 in. wing chord, and with ailerons of the same plan form but given a wash-out of 9 deg. throughout their length. A lateral force of 10 lb. was applied to the stick, and the time required for the airplane to bank to 45 deg. was noted. With regulation ailerons it took from 4.7 to 5.6 sec. on different

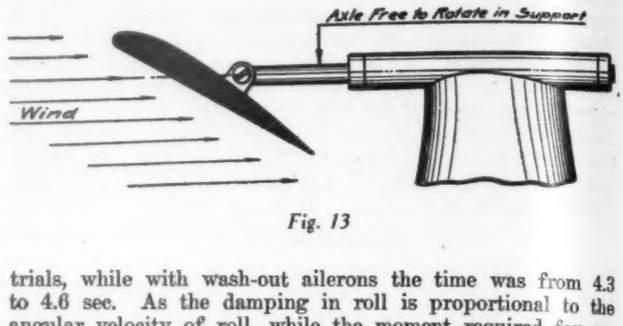


Fig. 13

trials, while with wash-out ailerons the time was from 4.3 to 4.6 sec. As the damping in roll is proportional to the angular velocity of roll, while the moment required for acceleration is proportional to square of the angular velocity, even a small reduction in time consumed in affecting the bank means a great increase of aileron efficiency.

Considerable publicity was given recently to the *differential aileron control* invented by Captain DeHaviland, prominent British designer. This consists of such gearing between control stick and ailerons, that the ailerons move up through considerably larger angles than down. The controlling action of such ailerons is similar to one of wash-out ailerons described above. There is a slight increase of *lift effect*, but by far the most important improvement comes apparently from the fact that secondary *drag effects* act with the *lift effect* rather than against it, as is the case with ordinary ailerons.

(To be continued)

545,000 Francs in Prizes for New Records

The French government has decided to renew for the year 1925 the prizes which it offered for the regaining or maintaining of world records. These prizes were originally offered in March, 1924. They consist of a prize of fr. 140,000 for the builder of the plane which holds the worlds speed record on Dec. 31, 1925, and a prize of fr. 60,000 for the engine used in said plane. A prize of fr. 100,000 is offered for the firm which builds a seaplane which will bring the worlds seaplane speed record back to France and in addition the builder of the engine for the seaplane will get fr. 50,000. The flying boat which brings back to France the distance record without refuelling in flight gets fr. 50,000 and fr. 50,000 additional if the endurance record is broken as well, the builder of the engine will get a prize of fr. 50,000 for the distance record with an additional fr. 20,000 for the endurance record.

If the altitude record is beaten again in France a prize of fr. 25,000 will be offered to the constructor who holds the record on Dec. 31, 1925. The same prizes apply to the altitude record for seaplanes.

Huff-Daland Sell to South America

Competing against French, German and English airplane manufacturers, contracts for American-built planes were signed April 17 between the Huff-Daland Co. and the Argentine Naval Commission, located in New York. The contracts call for eight training planes of the Petrel, Model 5 type, to be delivered to the Argentine Navy within five months. Contracts were awarded despite underbidding on the part of foreign concerns. The Huff-Daland Company was recently also awarded a contract by the State of San Paulo, Brazil, for a light bombing plane.

The planes are powered with Wright Whirlwind engines and are similar to the HN2 naval planes. These planes are substantially the same design as the small dusting planes, recently developed by the Huff-Daland Company for use in dusting cotton crops to control the boll weevil and in the dusting of other agricultural crops. Airplane dusting by these machines is now being undertaken for the first time in Georgia and other Southern states.

More Details of the Loening Amphibian

The announcement by the U. S. Navy Department of the McMillan Expedition to the Arctic, using the Loening Amphibian Plane, calls attention prominently for the first time to this new type of aircraft, which has been under secret development for over two years at the new aircraft plant of the Loening Aeronautical Engineering Corp. The principal idea in the Loening Amphibian is the use of the inverted type of aircraft motor, placing the propeller thrust at the top of the body and thus including the entire body with the engine mount in the nose to form a unit compact hull, carrying passengers, load, gasoline and all equipment. The landing gear, which is mounted to this hull, folds into it by the operation of an electric motor, switched on by the pilot. This hull body is made exceptionally strong, entirely covered with metal, and so shaped as to give remarkable seaworthiness which has been proven by tests in rough water carried on this winter in the Atlantic Ocean off Norfolk, Va., by a special Board of Army Pilots.

The crew sit well back and in the upper part of this unit body, where they are protected from spray and in a much safer position than has been, heretofore, found possible on flying boats. There exists, therefore, a very definite distinction between the Loening type of Amphibian, and other types of airplanes designed for land and water use, such as the Vickers Amphibian in Europe, which, like two or three machines of that type in this country consist of adding wheels to the old type of flying boat itself, but, carrying the engine up above between the wings. In flying tests that have been made by the Army Air Service the past few months, the flying qualities of the new machine were found to be quite remarkable, and to equal in every way the ordinary land type of plane of the same weight and power—so that enthusiasts for the new Loening type point out that it will very likely render the old limited type of land plane obsolete, as, not only is there no loss in performance or maneuverability due to the new type, but there is a definite gain in strength against crashing, and very much more room, made available for added loads to be carried. Since this type of plane can also land with equal ease on soft snow or hard ice by merely carrying retractable skis instead of retractable wheels, it becomes an ideal plane for Polar exploration, and, in fact, its development makes the present plans for the McMillan Expedition extremely practical and promising. The Loening Amphibian is fitted with an inverted 400 hp. Liberty engine. It weighs 3300 lb. empty, and carries a load of 2200 lb., including pilot, observer, cameras, radio and 250 gal. of gas, which is sufficient for a flight of over 1,000 mi. In the test conducted at the Army Air Service Engineering Division at McCook Field, Dayton, Ohio, this plane has recently demonstrated a high speed of 122 mi./hr., and a ceiling of 14,000 ft. The machine is readily hoisted aboard a ship and launched in the water, and may either be moored in a Bay, or with its wheels down, run up on to a beach. It handles in every way exactly like a seaplane, or exactly as a land plane, depending entirely upon the desire of the pilot.

Both the Army and Navy have ordered several of these machines, and a group of sixteen of the planes is now in process of delivery at the Loening plant. Last February, the first public demonstration of the new type was made in Washington, D. C., with Lieut. Wendell H. Brookley of the Army Air Service, giving an exhibition of flying before the Aircraft Investigating Committee of Congress, which at the time was commented upon, as quite a remarkable display—the machine being equally at home on Bolling Field, or in the Potomac River. It was at this time that General Mitchell stated to the Committee, that in his opinion, this machine represented the most satisfactory solution that he knew of for this difficult type of plane, and represented a real advance in aircraft engineering for which there would be a great promise.

Book Review

JAHRBUCH FUR LUFTVERKEHR 1924. By Fischer von Poturzyn, Junkers Air Transport Co. (394 pp. profusely illustrated. Richard Pflaum Verlag A.G. Munich.)

This is the first edition of an extremely useful reference volume produced in conjunction with the German Aero Club which is to be published annually. It is divided into seven sections with a bibliography and an appendix containing distances between important centers in Europe and Asia Minor, conversion tables, etc. The sections are divided into chapters, each written by an expert on the subject covered, many of whom are members of the German Air Ministry.

The first section reviews the birth and development of air transport. The second section is "International Air Transport at Present". The first chapter is by the author and gives a worldwide review of conditions. The second chapter gives the timetables and rates of thirty-nine airlines all over the world. The third chapter of this valuable section gives all the available data on 375 European airports in tabular form. The third section is entitled "Air Transport Policies and Economy," and contains five chapters. The fourth section treats of the effect of political economy on air transport. The fifth section, "Technical Progress", contains the greatest number of chapters and covers transport machines, light planes, gliders, radio, landing lights, engines and meteorology. The sixth section deals with civil aviation in Switzerland, and gives descriptions of the airports of Berlin and Prague. The last section is called "Special Uses of Aircraft" and covers aerial photography, newspaper delivery, etc.

The book is printed on a very good grade of paper and bound between boards. Inasmuch as the intention is to cover the whole world this volume should find a ready welcome outside of Germany, if for no other reason than for the tables and airway maps which are exceptionally complete and up to date.

The Ford Group—Wm. B. Mayo, Wm. Stout, Edsel Ford, Henry Ford and Eddie Hamilton, Pilot

The Economy of Air Cooling

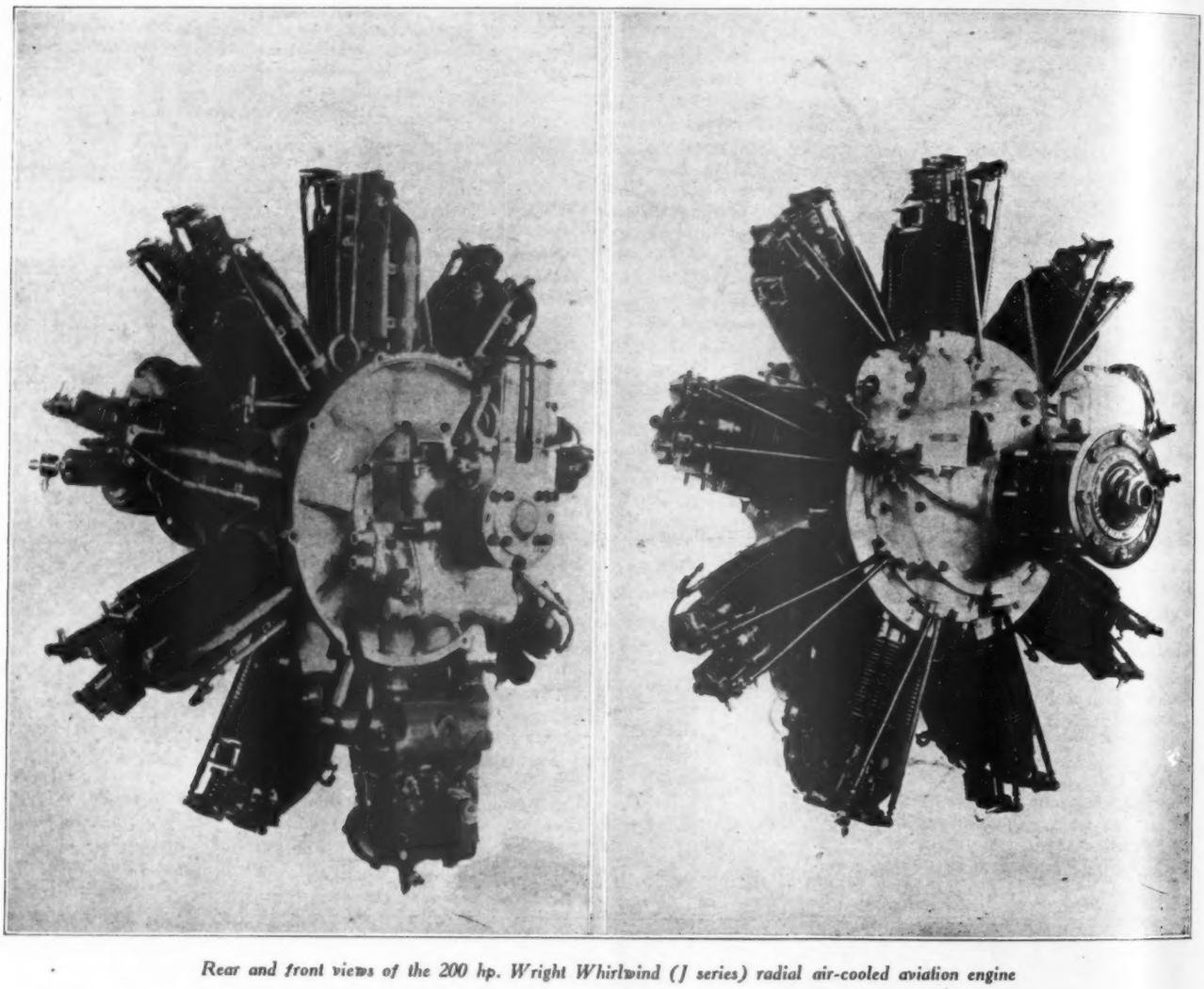
By K. J. BOEDECKER

Field Service, Wright Aeronautical Corp.

The air-cooled engine of the radial type is far superior to the water-cooled engine in the ease with which either a complete or a top overhaul may be made. Take the case of a top overhaul of the Wright Whirlwind (J series), 9 cylinder, 200 hp. air-cooled engine—this would mean the grinding of valves, removal of carbon, and possible renewal of piston rings or pistons—it can be done by one man, one cylinder at a time, between flights if necessary, without disturbing the timing or any other part of the engine and without removing the engine from the plane. Removal of each cylinder can be accomplished in approximately ten minutes. On a water-cooled engine with individual cylinders the cam housings must be removed or, with block construction, the blocks and cams removed and the engine re-timed. This means that a plane with an air-cooled engine can be kept in flight service continually when needed and that the top overhaul may be done in short installments with no fear of tying up the plane for an extended period.

Even if it is necessary to make a complete overhaul of the Wright Whirlwind it can be done by one man without removing the engine from the plane. In fact, in eight hours one man removed, repaired and replaced the crank shaft of one of these engines while it was still mounted in the plane. This can be done as follows: First remove thrust plate which is attached to crankcase front section by seven 3/8 in. studs and nuts—then the thrust nut which is threaded to the crankshaft. After the nine 5/16 in. nuts holding it to the crankcase intermediate section have been removed, the crankcase front section may be taken off, carrying with it the thrust bearing magnetos and magneto driving gears. Next the intake manifold and oil sump may be removed after removing the twelve 5/16 in. nuts which secure it to the crankcase main section. The cylinders may next be removed and then the crankcase intermediate section which carries with it the cam and cam followers. The connecting rods are now exposed and may be removed. Next the hand turning gear may be removed, which gives access to the crankshaft gear, the removal of which allows crankshaft to be drawn from the case. Next and last comes the crankcase rear section, which is secured to the main section by seven 5/16 in. nuts. The rear section carries with it the oil pumps, fuel pump, synchronizer shafts and tachometer drives. Now only the bare crankcase remains in the plane. The above operations need not be followed in the sequence noted, but may be carried out in several different ways.

An index of the simplicity and ease of tear down is evidenced by the fact that a tear down almost identical to the



Rear and front views of the 200 hp. Wright Whirlwind (J series) radial air-cooled aviation engine

above was made at a field where the engine was unknown to the mechanics.

Simplicity of Overhaul

The simplicity of construction is further shown by the fact previously related that in eight hours one man removed, repaired and replaced the crankshaft of one of these engines while it was mounted in a plane. This was accomplished by taking off the front and intermediate crankcase sections as a unit. This unit was composed of all the timing mechanism for magnetos and cams. A careful scratch mark across the face of the front section and on the magneto couplings allowed of replacement of the complete unit without the necessity of retiming the engine. With this unit off and with the three upper cylinders removed, it was an easy matter to remove the master connecting rod and two of the small connecting rods with their pistons, which gave ample room for withdrawal of the shaft. It was necessary, of course, to remove the gear at rear end of crankshaft before the crankshaft could be drawn out. The removal of the crankshaft was necessitated by damage caused by a broken starter. Following the same procedure as outlined above, either the crankpin bearing or rear main bearing, or both, could be replaced. To replace the intermediate main bearing, removal of front and intermediate sections as a unit would be the only requirement. To remove the thrust bearing, only the thrust nut and front plate need be removed. For practically any of the foregoing replacements or repairs on a water-cooled engine, removal of engine from the plane and complete tear down of engine would most certainly be necessary. The time and labor thus saved are big items in favor of the air-cooled engine.

Great Saving in Man-Hours

In a well equipped shop which has all the facilities, including special tools, for the complete over haul of both air-cooled and water-cooled engines, the time in man hours for overhaul of the air-cooled engine is from two-thirds to three-quarters of that required for the water-cooled engine. This time is based on a comparison of the requisite hours for the overhaul of the 200 hp. air-cooled engine and the 200 hp. water-cooled engine at the Wright Aeronautical Corp. plant, where both types of engines are built. If the hour of delivery is all important, here again the air-cooled engine is favored because more hands can be employed without interference with each other than is possible on the water-cooled engine. Of course, most repair bases are not as well equipped as a manufacturing plant and so the time difference is therefore greater—favoring the air-cooled engine, because fewer special tools and fixtures are required. Inquiry at different fields where both air-cooled and water-cooled engines are in use, invariably brings forth the response that the mechanics would rather overhaul the air-cooled engine because of the simple construction and accessibility. Also, the consensus of opinion seems to be that fewer replacements are necessary, that valves require less time to be ground to a perfect seat and that bearing troubles are infrequent in the air-cooled engine. The absence of bearing troubles is due to the short, rugged, single throw, balanced crankshaft in which whip is practically eliminated and the three generous ball bearings with their minimum friction and their capacity to stand considerable overloads. The crankpin has the only heavily loaded plain bearing in the engine, but its size is so ample that replacements are seldom necessary, except after hundreds of hours of operation.

How to Inspect Engine

For a general inspection of the crankshaft, crankshaft bearings and connecting rod bearings, the removal of the front and intermediate sections of crankcase as a unit is sufficient. An inspection of all timing gears, cams and cam followers may be made by removing only the front section of the crankcase. Inspection of accessory gears may be made through the starter hole in crankcase rear section or the entire section may be removed after the seven 5/16 in. nuts holding it to the crankcase main section and the accessory driving gear on crankshaft have been removed. Included in the rear section assembly are the gun synchronizer shafts, oil pumps—one pressure and two scavenger superimposed forming a single unit—oil strainer, oil pressure relief valve, tachometer drives and fuel pump, all of which are accessible and may be removed separately if desired whether the rear section is attached to the engine or not.

The accessibility of all parts of the air-cooled engine is so far superior to that of the water-cooled engine that actual comparison seems unnecessary. However, accessibility plays an important part in the lowering of inspection and overhaul costs and therefore cannot be stressed too much. After a certain hourage it is frequently desirable to perform a rather close, general inspection of the power plant whether or not there is any indication of trouble. Accessibility is the best insurance that the desired inspection will be performed, for inaccessibility leads to procrastination, and delay in performing a necessary inspection may result in a considerable loss of time. The fact that the air-cooled engine may be left in the plane for a general inspection and that the time required for this inspection is less than would be required to remove an engine and install a new one of either type makes its use very desirable, especially where time saving and the maintenance of fixed schedules are important factors.

One Man Can Do Overhaul

When it is fully realized that all of the labor required to properly inspect and overhaul an air cooled engine, either in the plane or on an overhaul stand, can be done by one man, it will readily be apparent that the cost of overhaul will be very much less than that of a water-cooled engine.

Again, if it is deemed desirable to replace a complete engine, the time required is less for an air-cooled engine than for a water-cooled engine which must, in most cases, have its radiator and attendant pipes and connections removed.

In summer or in the tropics there is the freedom from water boiling and in the winter the fear of freezing and bursting of pipes, radiators and water jackets is eliminated. Then, too, the labor of draining the water every time the ship is laid up for the night and the subsequent refilling in the morning, is done away with. The air-cooled engine may be warmed up in about one-third to one-half the time necessary for warming up a water-cooled engine, which again is a saving in time.

Runs on Commercial Gasoline

Commercial gasoline may be used if nothing better is obtainable and any good grade of mineral oil. The fuel and oil consumption is comparable with that of water-cooled engines. A two-place observation plane powered with the Wright Whirlwind 200 hp. air-cooled engine and carrying a full military load has flown 465 mi. on a closed course at approximately 79 mi./hr. in 5 hr. 52 min., using only 44.7 gal. of aviation gasoline. This is equivalent to 7.6 gal./hr. or 10.4 mi./gal.

One of the main points in favor of the air-cooled engine—one which affects ultimate costs from a commercial viewpoint and high speed and ceiling from the military—is its light weight in pounds per horsepower. This light weight is reflected in the design of the plane which can be considerably lightened and thereby increase its pay load capacity or speed. The advantages in performance are shown in the comparison of two very similar planes built by the same plane manufacturer and powered—one with a Wright Whirlwind (J4) 200 hp. air-cooled engine and the other a Wright Tempest (E4) 200 hp. water-cooled engine. The following table gives this comparison.

INFLUENCE OF ENGINE WEIGHT ON USEFUL LOAD AND PERFORMANCE

Engine model	"Tempest"	"Whirlwind"
Engine type	Water-cooled	Air-cooled
High speed (full load, sea level)	118 mi./hr.	136 mi./hr.
Low speed (full load, sea level)	52 mi./hr.	53 mi./hr.
Cruising range	309 mi.	406 mi.
useful load—Full load	30%	37%

Gear Representative

Foote Bros. Gear & Machine Co., producers of aviation engine gears, recently completed arrangements for representation of IXL Speed Reducers and Gear Products in Mexico by John A. Park, Gran Hotel, Avenida Uraguqy 12, Mexico City.

AIRPORTS AND AIRWAYS

Philadelphia, Pa.

By C. T. Ludington

During the last few weeks the greatest excitement in Philadelphia Aviation activities has been the launching of the aircraft carrier Saratoga from the plant of the New York Shipbuilding Company. A squadron of Marine Corps ships, including Martin bombers and Voughts landed at the Camden Forge Field back of the New York Ship, other Navy ships and a squadron of five Army ships under Lieut. E. E. Aldrin of the Air Service Engineering School at Dayton, landed at the Naval Aircraft Factory Field. At the exact moment when she struck the water Victor Dallin had his Swallow in the exactly correct place and got a remarkable photograph which appeared in New York and Philadelphia papers. The evening of the launching a dinner was given for Lieutenant Aldrin and his comrades from Dayton, by members of the Aero Club.

Final plans for the Municipal Field have been approved by the Mayor and further developments are up to Council and the legislature in Harrisburg. In connection with attempts to discover how many ships are operated in this vicinity, and might be expected to make at least occasional use of this field a list was prepared of Pennsylvania and New Jersey operators. It was found that twenty-three operators are making use of fifty ships, having a total passenger capacity of seventy-four. Philadelphia now feels itself much more of an aviation center than previously.

Pitcairn Aviation managed by J. A. Ray has at present seven students and, despite the absence of Harold Pitcairn in Europe, is reported to be progressing nicely. This company shows in the "census" as the largest operator in the vicinity of the city with the Ludington Exhibition Co. and the Essington School of Aviation a close second and third.

At Pine Valley experiments with the new night flying equipment, some of which is at hand, have begun. Victor Dallin recently went away on a photographic trip to Boston, and on his return plans to leave for Canada to fulfill a contract there. The Ludington Exhibition Co. has made a deal with the Aero Service Corporation whereby they will take over from the latter company a large amount of surplus equipment. This will enable this company to give service from Pine Valley on nearly every type of ship, or engine being operated commercially or privately in this vicinity.

Cleveland, Ohio

By Cy Caldwell

In a recent issue of AVIATION Porter Adams of Boston says he likes to read my notes, and that he even skips the Publisher's News Letter until after he sees what I have to say. Well, so do I. And I certainly appreciate this tribute from Boston where all that is best in literature is recognized at a glance.

Mr. Adams has brought the number of my readers up to two. The other one is the proof-reader. I know he reads my stuff for it comes out all cut and changed—grammar and spelling and everything. Between ourselves, Mr. Adams, I fear he doesn't appreciate me like you and I do.

Mr. Adams would like my column to become a regular feature he says. Now if you really mean that, Mr. Adams, I suggest that you ship me a few airplanes and aerial features to report back on, for there is a great dearth of material here.

There has been the usual Spring announcement of an Airline to operate between Here and There. And when I actually see the Airline I'll report its activities in full. But all I've seen each Spring so far has been the announcement. And you can't fool an old soak with Bevo.

Then I hear there is, or is to be, a flying school where the youth of this hamlet with the accent on the first syllable, may learn all the niceties of piloting until they reach such pinnacles of fame as those occupied by Casey Jones or Harold R. Harris. But until I actually see the planes flying and landing—and bouncing—and the dazed pupils climbing out of them—and the instructors swearing, as they usually do; —well, until I see and hear that I shall not report on the school.

Actually, Mr. Adams—hereafter I shall ignore the proof-reader and write for you alone—actually, C. W. Grove, Cleveland contractor, whose slogan "Be your own landlord and have *all* the worry" has sold hundreds of homes, has bought an S.V.A. which he has erected on the Glenn L. Martin Field and will fly for pleasure or annoyance as the case may be.

I think that about covers the news from these parts, Mr. Adams. Grape-fruit are going up in price and down in quality, early rhubarb is in, and the chunks of ice in the refrigerator seem even smaller than they did during the winter. This is not really air news, but then one must write of something, mustn't one? As they say on Beacon Street.

• • •

Bug-House Fairy Tales

Once upon a time there was a young pilot who bought a Jennie and amassed a vast fortune carrying passengers on Sundays.

Boston, Mass.

By Porter Adams

June fifteenth has been set as a tentative date for a meeting of representative Boston business men under the auspices of the Boston Chamber of Commerce to discuss the most efficient use of the Air Mail and to ascertain if possible just how much air mail business can be obtained. This meeting will be under the joint direction of the committee on aviation and the committee on postal facilities of the Boston Chamber of Commerce. It will take the form of either a luncheon—or dinner—and Col. Paul Henderson has notified the chamber that he will be present. Boston has long been talking of the air mail and this time the matter is going to be put squarely up to the business men of the city to find out just how much this talk actually amounts to. It is believed that with the advent of night flying on the eastern division the business men of Boston cannot fail to appreciate the actual value to them in dollars and cents.

• • •

On April 15, Pilot Victor Dallin landed at the Boston Airport after a three hours flight from Philadelphia. He brought a message from Mayor Kendrick of Philadelphia to Mayor Curley of Boston. This letter was carried in connection with the 150th anniversary of the battle of Lexington and Concord which was celebrated here the 19th of last month. On the return flight Pilot Dallin carried a message from Mayor Curley to the Mayor of Philadelphia expressing Boston's interest in the exposition to be held there next year.

• • •

Considerable interest exists at the Boston Airport in the question "How high can a Jenny fly." A record of 10,200 ft. was made over the airport the middle of March, and last week this record was extended to 13,500 ft. by Lieutenant Bech. Roger W. Twitchell of Milton has stated that in 1918 he flew a Jenny to 13,400 ft. in Mississippi. On Thursday of last week, Maj. Herbert A. Dargue, flew to Boston from Washington in 4 hr. It was good to see Major Dargue again at the Boston Airport which he commanded so efficiently at the time of the arrival of the world flight. He stated that great improvement had been made in the airport and having flown at practically every field in America whatever he has good to say about the Boston Airport is especially appreciated. This airport he stated was the best located municipal airport in the nation.

The total flying time for Boston and vicinity for the week was 44 hr. and 10 min. of which the Navy had 15 hr. and 4 min. and the rest was divided between the Army, National Guard and organized reserve. The longest single flight of the week was made by Lieutenant Thomas of the Navy in a seaplane on Saturday with 245 min. Lieutenant Doolittle made an extended flight in the new DH4B assigned to the airport and flew for 3 hr. and 50 min. covering 400 mi.

* * *

A meeting of the Boston Municipal Air Board was held at the City Hall on Tuesday April 14 for the purpose of discussing plans for a commercial hangar at the airport. This was the same day that the Boston Braves opened their baseball season and the opening showed plainly in the small attendance at the Air Board meeting. It was reported however that at least one quarter of the total amount necessary had been already raised.

Milwaukee, Wis.

By Daniel Kiser

While everyone in this vicinity is acquainted with what is transpiring at other fields in the country, it may seem that, so far as Milwaukee is concerned, it isn't in the aviation game at all. However, while we all read the news of other fields in AVIATION weekly, it hasn't dawned on anyone to tell about what we are doing in this line, and I hope that this will straighten out this discrepency a bit, and help to include us in the news along with the rest of the United States. And, then too, the State which boasts the home of Colonel "Billy" Mitchell, should at least be represented.

A little past history, say for a year or so may prove enlightening. We have a County-owned airport located on Lisbon Road ten miles northwest of the City Hall of Milwaukee. The field is L shaped located on high ground and suitable for use in any weather. During the season of 1924, 14 students were trained of whom 6 purchased planes and the remarkable feature is that to date not one of these men has yet to record a crash or even minor difficulties, and all of them have made numerous cross-country trips, one having covered over 15,000 mi. of cross-country within 9 mo. One young lady, Miss Helen Czapiewski, has also completed a flying course and soloed successfully.

During 1924, 6 new Canucks were built up at the shops at New Butler and 11 ships of various types re-built. Since January, 1925 new planes, as yet unassembled, and awaiting better weather for assembly, were delivered to M. Warshauer of Milwaukee and Don Campbell of Waukegan, Ill. Both planes are of the Canuck type.

At the present time, the ships at the field either assembled or in storage are as follows:—

M. Warshauer, Hisso Standard Speedster, Milwaukee.

R. G. Conant, Westfield, Wis. OX5 Standard.

S. M. Cushman, Canuck, Milwaukee.

Eugene Hosenmiller, Canuck, Milwaukee.

Louis Benson, Canuck, 4 uppers, Menomonee Falls, Wis.

Edw. Szukalski, E1 Standard Scout, 80 LeRhone, Milwaukee.

A. Padags and J. Doleshy, Canuck, Milwaukee.

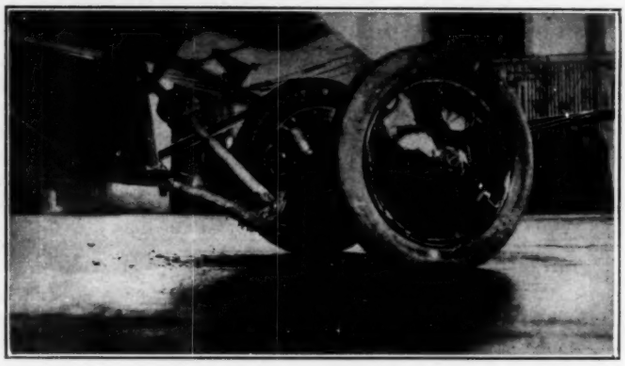
Daniel Kiser, Canuck, New Butler, Wis.

In the shops at New Butler and nearing completion are a TM Scout with OX5 for Gilles Meisenheimer of Milwaukee, and a special four lower panel, streamline nose Canuck for C. H. McMillan of Fond du Lac, Wis. Also in the shops, last but not least, and undergoing considerable changes in design and construction, the Lawson 16-passenger Air-Liner with twin Liberties, now owned by George Bowman, Wm. Schroeder and Daniel Kiser. The above parties also have a new HS2L flying boat stored in the shops, and last year had the misfortune to lose a boat of this type during a bad storm which tore it lose from its moorings at McKinley Beach in the Milwaukee Yacht Club's harbor, and smashed it to pieces against a concrete pier.

During the winter of 1923-24 and also 1924-25, considerable flying was done by the writer with a Canuck equipped with skiis. Considerable interest is being shown in aviation in this vicinity and 5 students are now under training at the Flying School, which operates at the Airport.

Duncan Field

The airdrome at San Antonio Air Intermediate Depot, Tex., is designated as "Duncan Field," in honor of Maj. *Thomas Duncan*, Air Service, who was killed in an airp'ane accident at Bolling Field, Anacostia, D. C., on May 25, 1923 in a recent General Order.



The special dolly and tailskid arrangement on the Aerial Mercury

Civil Aviation Statistics

The following tabulation of world civil aviation statistics is part of some figures presented in the Italian Chamber of Deputies recently. The figures cover the year 1923 and show that American civil aviation is certainly the equal of any foreign country in the number of airplanes available and the amount of mail carried.

FRANCE	
Distance covered in a year	2,104,803 mi.
Passengers carried	11,638
Freight carried	2,135,676 lb.
Mail carried	723,881 lb.
Registered civil airplanes	1,337
Licensed civil pilots for public transport	843
Licensed civil pilots private	172
Licensed civil pilots lighter-than-air	102
Licensed civil flying field managers	9
Licensed ground engineers	33
GREAT BRITAIN	
Number of flights	4,572
Passengers carried	15,123
Loads carried	1,819,754 lb.
Registered civil airplanes	1,143
Licensed civil pilots	795
Licensed ground engineers	819
GERMANY	
Distance covered in year	1,097,870 mi.
Passengers carried	26,509
Load carried	147,745 lb.
Registered civil airplanes	227
Licensed civil airplane pilots	346
Licensed civil airship pilots	5
UNITED STATES	
Distance covered in year (air mail)	1,165,387 mi.
Mail carried	1,632,348 lb.
Civil airplanes	1,300
Civil airplane pilots	600
ITALY	
Registered civil airplanes	170
Licensed civil airplane pilots	54
Licensed private airplane pilots	6

German Air Travel Notes

The German company Westflug G.m.b.H. Bad Oeynhausen in the period July 2 to Dec. 31, 1924, carried 2668 persons and 10,152 lb. of freight in 869 flights. In this same period 25,128 mi. were flown. This company operated in the provinces of Hannover and Westphalia as well as flights to the islands of Borkum, Juist, Langeoog, Norderney and Wangeroog.

The success of the air services to the Leipzig spring fair last year has led the German companies to arrange a more complete and better service for this year's. The companies undertaking the service are the Junkers Luftverkehrs the Trans-Europa Union, the Sachsischen Luftverkehrs and the Schlesischen Luftverkehrs. Planes will leave Chemnitz, Dresden, Hannover, Berlin and Breslau daily between 8:00 and 9:30 every morning for Leipzig. Return flights for the same cities will leave Leipzig from 3:00 until 5:00 in the afternoon. This arrangement will permit a business man to look over his morning mail and then spend the day at the fair, returning in the evening.

UNITED STATES AIR FORCES

U. S. ARMY AIR SERVICE

British Fliers Jump

Group Capt. M. G. Christie, Air Attaché of the British Embassy, Flight Lieutenant Soden and Flying Officer Lacey of the British Air Service, successfully accomplished live jumps from DeHaviland planes at a height of 2,000 ft. over Chanute Field recently. This series of parachute jumps was an excellent demonstration of the feasibility of the practical operation of this factor of safety in connection with its adoption to passengers or persons having little or no knowledge of parachutes, for Captain Christie had but an hour or more of instruction before making his jump. Lieutenant Soden and Flying Officer Lacey spent a week at the Air Service Technical School at Chanute Field taking intensive training in parachutes.

Congressmen Fly

Five members of Congress recently made a record flight across the Panama Canal Zone from Albrook Field to France Field. They flew in DeHaviland planes piloted by Lieutenants Reid, Sloan, C. W. Sullivan, Zane and Gaffney of the Army Air Service. Leaving Albrook Field on the Pacific side at 10:30 a. m., they landed at France Field on the Atlantic side at 10:53 a. m.

Lieut. Hugh Minter, Wimsatt and Kennedy gave the Congressional party a warm reception by simulating an attack on the incoming party while they were circling over France Field at an altitude of 5000 ft. The Congressman expressed surprise and astonishment at the maneuvering ability of the pursuit planes in action. The Congressional party consisted of Congressmen Gordon Browning (Tenn.); W. G. Sears (Nebraska); Seger (New Jersey); A. E. Winter (Wyoming) and W. H. Hastings (Okla.).

After a brief inspection of France Field, the Congressmen boarded the U. S. Putnam, France Field's fast motorboat, where all enjoyed a very pleasant luncheon which had been prearranged by Capt. Charles E. Rust and Warrant Officer Harrison Billingsley. The luncheon was served while the boat was cruising through the old French Canal toward Gatun Locks. Upon return from the boat ride at 3:30 p. m., the Congressmen were flown across the Isthmus to Albrook Field. All expressed their utmost confidence in the U. S. Army Air Service and declared that the United States should have an Air Service second to none.

National Guard Flying in Connecticut

With the coming of Spring, members of the 118th Observation Squadron, Air Service, Connecticut National Guard, are in the air every day at Brainard Field, Hartford. Flying has been going on all during the winter, but with better flying conditions and the field in better shape the activities have taken on new vigor. The winter training of the Squadron continues to be carried on in the quarters of the Squadron in the State Armory at Hartford. This consists of lectures and class work in Engineering and Rigging, Armament, Radio and Photography, as well as the School of the Soldier.

The Squadron also endeavors to keep aviation before the public, various lectures having been given. Lieutenants Arnold and Wade of the Round-the-World Flight were guests recently of the Hartford Aero-Guards, and in the presence of a large audience gave a lecture together with moving pictures of the Flight.

The Squadron numbers 18 officers and 80 men. There are two fireproof hangars on Brainard Field, containing seven ships in first-class flying trim. Four men are stationed at the field for twenty-four hour service. Any member of the Air Service is always welcome at Hartford. The 118th Squadron meets every Wednesday at the State Armory at 7:15 for drill.

Douglas Cruisers

Two Douglas Cruisers were recently received by the Air Service at Kindley Field, Fort Mills, P. I., and they were a welcome sight to the pilots of the Field. Both ships were assembled and flight tested. The *Air Service News Letter* correspondent states that they handle beautifully in the air, have a very quick take-off, and that they were a revelation to the Navy pilots who are equipped with an old type Douglas Cruiser which requires an exceptionally long run to get off the water. With all modern improvements, such as a self starter, etc., it is like a modern automobile, and already a great many pilots in the Philippines are anxious to be assigned to Kindley Field. Shortage of gasoline has thus far limited flying in these two ships, but with the expected arrival shortly of 5400 gal. of gas the boys on the field who are anxious to fly will be able to do so to their heart's content.

Eludes Searchlight

For the benefit of the Anti-Aircraft Reserve officers of El Paso, the 12th Observation Squadron, stationed at Biggs Field, El Paso, Tex., staged on the evening of March 23 a 20-min. night flying and searchlight demonstration.

A powerful searchlight mounted on a truck attempted to locate a DH plane piloted by Lieut. Ray H. Clark, who with Staff Sgt. H. Williamson flew about the vicinity of the airdrome for about 20 min. at an altitude of 1,000 ft. Before landing the plane dropped a parachute flare which failed to function until it was 400 ft. from the ground.

Officially, the demonstration was considered a success. Actually, however, to those who witnessed the feat, there were a number of marked discrepancies between theory and practice that one could not help but notice. The searchlight, which presumably had a range of 10,000 ft., was able to pick up the plane only at a very short distance. When the plane was followed to the extreme length of the beam it faded into the night and could not be seen. Furthermore, the motor that generated the power for the light made so much noise that the operator of the light could not hear the plane unless it was very close, a state of affairs which, of course, would not exist under actual war time conditions. In fact, it was only by the steady cooperation of the pilot that the searchlight was able to pick up the plane at all. It is easy to surmise how helpless such an instrument would be in an actual bombardment, with a bombing plane flying even at an altitude as low as 5,000 ft.

Pope Field Fires

Fire fighting from the air, writes the *Air Service News Letter* correspondent under date of March 25, was the constant occupation of a large part of the Fort Bragg garrison for the past week. The continued dry weather had left the entire reservation in an extremely inflammable condition, and when fires started to break out about ten days ago it required constant fighting day and night to stop them. Several fires were started by shells during artillery firing. Several more burned in from off the reservation, and two very severe ones were either set or started from carelessness on the part of someone traveling over the government land.

The first big fire resulted in the calling out of about 800 men of the garrison to check it. Pope Field was requested to send out a plane to make a reconnaissance of the fire area and to see where it would be best to fight it. It was during this flight that the big advantage of direction from the air was realized. Lieut. H. W. Holden, with Lieut. W. T. Meyer, pilot, was able to direct several truck loads of men to points where the fire could be fought with advantage, and he was able to keep a close check on the progress being made and call for more help when needed at any point. This fire was finally subdued after a day and night of fighting.

The following morning, with Lieut. Glen T. Lampton piloting, Lieutenant Holden discovered another dangerous fire on

the western side of the reservation. A quick call to camp by radio started men at once to the scene. It was a two-hour journey by truck to the fire, and as the wind was blowing briskly the fire had a fine start before the attack was started. By the liberal use of back-fires along roads fronting the fire it was finally controlled after a 24 hr. fight, but not until about 20 sq. mi. had been burned over.

The following afternoon a big fire on the northern boundary brought another call for an airplane reconnaissance. The fire was burning against the wind and a call for 200 men seemed sufficient to stop it. The fight by these men was started just about sundown and everything went well until about 10 o'clock when, with the fire nearly out, the wind changed and in a very few minutes the fire fighters had to beat a hasty retreat. An early dawn reconnaissance the next morning led to a call for every available man in camp to be turned out at once and men and trucks were sent over the roads to the fire 15 mi. away. At least 2000 men were fighting the fire by 10 o'clock and, while it was impossible to stop it in many places due to the high wind, back-fires were started and saved most of the houses and range-stations which were in the path of the flames. Lieutenant Holden and Lieutenant Lampton were in the air almost constantly directing the work. A radio station was set up near the center of operations and received many messages regarding the fire.

Lieutenant Holden had a large supply of tobacco tins to use for dropping messages at various points, these especially being used in communicating with Lieut. J. D. Balmer, F.A., Provost Marshall, who was directing the fire fighting on the ground. A slight let up in the wind about noon gave the fighters a chance, and a quick redistribution of the men along roads fronting the fire saw the beginning of the end. Back-fires and back-breaking work with fire fighting utensils finally brought the flames to a stop after another three hours of work. The airplane was constantly on the job flying through the thick smoke and watching for small fires which might break across the line of defense. Several times these small fires were discovered and a hurried call issued to the nearest detail. The men would be guided to the fire by the plane and then the plane would return at frequent intervals to watch the progress of the fighters. Many times during the day Lieutenant Holden issued instructions by voice. The plane would fly low and with the engine idling Lieutenant Holden was able to make himself heard by the men on the ground. Most of the fighters were able to return to camp by midnight, but another 100 men had to be sent to the fire area the next morning to fight small fires that sprung up around the edges, and again the airplane direction was able to greatly expedite the work. The total area burned by the last big fire is estimated at about 70 sq. mi. Several old farm houses which were used as camp sites for hunting and camping parties were destroyed and many hundreds of dollars worth of damage was done to the best longleafed pine area on the reservation. It is estimated that at least 150 sq. mi. of land were burned over during the past 10 days and during the three big days of fire fighting Lieutenant Holden and Lieutenant Lampton put in about 15 hr. in the air. Needless to say, the entire camp took a day of rest following the last big fire.

Army Air Orders

The promotion of Sec. Lieut. George Leroy Murray, A.S. Res., Bolling Field, to first lieutenant is announced.

Maj. Carlyle H. Wash, A.S., Washington, to Kelly Field.

Sec. Lieut. Anthony Levin Merrell, A.S. Res., Hampton, Va., to active service Washington, for training, reverting to inactive status May 18.

Lt. Col. John H. Howard, A.S., Fort Leavenworth, to Baltimore.

Maj. Leslie MacDill, A.S., Fort Leavenworth, to McCook Field.

Maj. Lawrence W. McIntosh, A.S., Fort Leavenworth, to Washington.

First Lieut. Julian B. Haddon, A.S., Brooks Field, to San Francisco, sailing on transport June 17 for Philippine Islands.

First Lieut. Charles G. Brenneman, A.S., Philippine Dept., to Crissy Field.

Lt. Col. Benjamin D. Foulois and Maj. John B. Brooks, A.S., Fort Leavenworth, to Mitchel Field.

Maj. John N. Reynolds, A.S., Fort Leavenworth, to Fort Bliss.

Sec. Lt. Merrill D. Mann, A.S., Hawaiian Dept., to Chicago, Ill.

Sec. Lt. Cecil E Archer, A.S., McCook Field, to San Francisco, sailing on transport July 8 for San Francisco.

Spec. Or. 254, assigning First Lt. Kenneth N. Walker, A.S., to Chanute Field, amended to assign Lieutenant Walker to Langley Field.

Sec. Lt. James B Davis Palmer, A.S. Res., Washington, to active duty Langley Field, for training, reverting to inactive status April 30.

First Lt. Harold R. Rivers, A.S., Scott Field, to San Francisco, sailing on transport May 14 for Hawaiian Islands.

Resignation of Sec. Lt. Charles Heath Heyl, jr., A.S., of commission accepted.

Sec. Lt. Halley G Maddox, A.S. (Cav.), Brooks Field, to Fort Huachuca.

First Lt. Glenn Paul Rodgers, A.S. Res., Langley Field, promoted to rank of captain.

Spec. Or. 80 amended to relieve First Lt. Hjalmar F. Carlson, A.S., from duty Panama Canal Dept. Lieutenant Carlson is to sail on first transport for New York City, report for observation and treatment at Walter Reed Gen. Hosp., upon completion of which he is assigned to duty Mitchel Field.

Resignation by First Lt. Charles Norton Monteith, A.S., of commission is accepted.

Capt. Orlo H. Quinn, A.S., Langley Field, to Washington.

Sec. Lt. Elbert Kelly, A.S. (Inf.), Kelly Field, to San Francisco, sailing on transport June 16 for Hawaii.

Maj. Maurice Robert Smith, A.S. Res., Kansas City, to Scott Field.

U. S. NAVAL AVIATION

Naval Air Orders

Lieut. Joel J. White, det. Army Sch. of Av. Med., Mitchel Field, to N. Y. Nav. Air Sta., Lakehurst.

Ch. Gun. Fayette Myers, det. Nav. Air Sta., Coco Solo, to treatment Nav. Hosp., M. I., Cal.

Lieut. Harry P. Krummes, det. Army Sch. of Av. Med., Mitchel Field, to Pensacola.

Lieut. (jg) Winfored P. Dana, det. Army Sch. of Av. Med., Mitchel Field, to temp. duty Rec. Ship.

Ens. Luther S Schmidt, det. U.S.S. Pittsburgh to Nav. Air Sta., Pensacola.

Lieut. Julian B. Noble, det. Aircraft Sqd. Battle Flt., to Nav. Air Sta., Pensacola.

Lieut. Harold B. Sallada, det. U.S.S. Richmond, to Coco Solo.

Lieut. James H. Stevens, Aircraft Sqd., Battle Flt., to Nav. Air Sta., Pensacola.

Bosn. Anthony Feher, det. U.S.S. Langley, to Nav. Air Sta., Pensacola.

Lieut. Braxton Rhodes, det. U.S.S. Langley, to Nav. Air Sta., Pensacola.

Comdr. John Rodgers, det. Nav. A.S., Pearl Harbor, to command U.S.S. Wright.

Lieut. John B. Kneip, det. Inspr. of Nav. Aircr., McCook Field, to Aircr. Sqd., Battle Flt.

Lieut. (jg) Charles Bell, det. U.S.S. Denver, to Pensacola.

Lieut. James D. Lowry, det. Rec. Ship, San Francisco, to Pensacola

Ens. Gilbert R. Crowther, det. Off. Nav. Com., Navy Dept., to Pensacola.

Ens. Charles H. Memm, det. U.S.S. Utah, to Pensacola.

Ens. Joseph J. Rooney, det. U.S.S. Texas, to Pensacola.

Lieut. (jg) Walter F. Boone, det. U.S.S. Burns, to Pensacola.

Ens. Howard L. Young, det. U.S.S. Sturtevant, to Pensacola.

Lieut. (jg) Irving O. Wiltsie, det. U.S.S. Cleveland to Pensacola.

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Publisher's News Letter

Everyone knows that the principal source of revenue of any publication is from the advertising. In the case of trade papers it is supposed to come from the industry in which the paper circulates. With aeronautical papers a very odd situation exists. The possible advertisers are of three classes. There are the aircraft manufacturers who sell aircraft to the government. There are the engine builders. And then there are the independent aircraft constructors, commercial operators and accessory manufacturers. The first group probably receive from the government, aircraft orders that amount to between five and ten million dollars a year. And yet it will surprise our readers to know that they advertise in AVIATION so sparingly that the total of their accounts amounts to only 17 per cent of the revenue of the paper. It is the best kind of evidence that many regard their work as that of munition makers who think only of sales and nothing of building up good-will for their products. This condition is fundamentally unsound, for the government is making every effort to encourage aircraft constructors with the hope that someday they will become interested in commercial aviation and some of the overhead that the government has to pay for now will be carried by sales, other than to the Air Services.

* * * *

When the list of aircraft manufacturers is considered from the standpoint of invested capital, the uncertainty of the business becomes evident. Orders are given for hundreds of thousands of dollars to companies that haven't so much as a factory of any permanent character. As some of the companies maintain large plants with permanent staffs, these are at a decided disadvantage when it comes to making prices. The result is that the bidder that only has modest factories facilities can undersell the more substantial concerns. This makes the aircraft business revolve in a vicious circle; the large companies tending to become smaller while the smaller ones doing little to substantiate the basis of government support—creation of a reliable and adequate source of supply for an emergency.

* * * *

British aircraft constructors, in contrast, are advertising their commercial aviation successes. The Napier Company advertises the reliability of its aeronautical engine by giving a record of 14,000 miles with one engine on commercial service—four others have 100,000 miles each to their credit. They also are advertising of the flight of Major Zanni in a "Fokker" machine from Amsterdam to Hanoi (7,500 miles) in 17 flying days without touching his engine at all. The Armstrong Siddely Company and the De Havilands are taking due credit for the flight of Sir W. Sefton Brancker and Alan J. Cobham from England to India and return; 17,000 miles in 220 hours flying time on a De Haviland airplane fitted with an Armstrong Siddely "Puma" engine using only one engine for the round trip. This flight was made to investigate an air route to the East. The Fairey Company are advertising the flight by Wing-Commander Goble on a Fairey seaplane completely around the coast of Australia for which the Britannia Trophy has been awarded; it being considered "the most meritorious of the year." Rolls-Royce, Ltd., announces new world records for seaplanes with speed over 500 km. and 250 kg. of useful load in the speed and endurance classification. The plane was the Danish-built Rohrbach all-metal monoplane with two Rolls-Royce engines. Then the Aircraft Disposal Company also advertises that it prepared and supplied from its stock of surplus aircraft supplies the "Puma" engine used in the England-India Flight.

* * * *

It will be seen that in England, the aircraft manufacturers who manufacture for the government are not only laying emphasis on the commercial possibilities of their products but seeking a world market. Unfortunately, up to the present time, Liberty engines, of which thousands are available, have been used in almost all commercial air work in this country, so there has been no possibility of American engine makers taking credit for the remarkable achievements. When the great flights have been made the makers of gas, oil and accessories have "Told the world" in the general magazines but very seldom in aeronautical publications.

The British Aircraft Industry is reaching out for foreign markets as is indicated by the fact that in 1924 there were 137 airplanes of different types exported from England. From all indications, the British built aircraft are no better than those that have made successful performances in this country. But there seems to be little or no effort made here to make markets abroad.

But it is apparent that they intend to get out of the munition class at the earliest practicable opportunity.—L.D.G.

Douglas Light Plane Engine $350.00

Immediate Delivery from Long Island City

Specifications:

45 cubic inches, 2 cyl. opposed type; 22 h.p. at 3500 r.p.m., 30 h.p. at 5500 r.p.m. Weight 72 lbs. complete with magneto, carburetor, outside flywheel and controls.

Two throw crankshaft with special balanced counterweights insures smooth running at all speeds.

Large overhead valves, in readily detached head, are actuated by individual cams. Large ball bearings at each end of crankshaft.

Efficient lubrication of rocker arms provided by hollow heat dissipators acting as small oil reservoirs.

Performance:

Won both speed and altitude prizes at 1923 Lympne and Hendon air meets. Made 90 m.p.h. Fitted to Parnall Pixie. Avro with this motor attained 13,850 ft. altitude.

FIRST $25 CERTIFIED CHECK, TELEGRAPH OR MONEY ORDER OR CASH DEPOSIT WILL HOLD THIS MOTOR FOR PURCHASER'S INSPECTION.

Ask for Details On Other Light Plane Motors

AIR TRANSPORT EQUIPMENT, INC.
LONG ISLAND CITY, N. Y.

Aircraft Magazine Files For Sale

PRICE **10 cents Plus Postage**

Can be sent parcel post C. O. D. if desired

Aeroplane (English), 1916, 20 copies; 1917, 8 copies; 1918, 1 copy.
Flying (American), 1915, 11 copies. 1920. 1 copy.
Aerial Age, 1921, 11 copies; 1922, 5 copies; 1923, 7 copies.
Aircraft (Australian) 1921, 3 copies.
L'Air (French), 1923, 24 copies; 1924, 23 copies.
International Aeronautics, 1923, 3 copies.
Flug-Woche (German), 1923, 10 copies.
L'Ala D'Italia (Italian), 1922, 3 copies; 1923, 8 copies.
Revue De La Aeronautique Militaire (French), 1922, 2 copies; 1923, 5 copies.
L'Aerophile (French), 1921, 4 copies; 1922, 5 copies; 1923, 8 copies.
Aerea, 1924, 7 copies.
Z F M, 1923, 8 copies; 1924, 7 copies.
Bulletin De La Navigation Aerienne (French), 1920, 3 copies; 1921, 4 copies; 1923, 9 copies.

DUPLICATES

Aerial Age, 1921, 6 copies; 1922, 1 copy.
L'Ala D'Italia, 1922, 1 copy; 1923, 3 copies.
L'Air, 1924, 2 copies.

Gardner Publishing Company, Inc.
225 Fourth Ave. **New York City.**

Fly with the Government Mail

"Post Master General New announces that all but foreigners will be encouraged to organize flying machine routes and allowed to carry mail under Government contract as railroads carry it."

This editorial by Arthur Brisbane foretells the beginning of another important step forward in aviation in this country. It offers encouragement to thousands of young Americans with "flying blood" in their veins, to take to the air. It is the chance of a lifetime.

The motors listed below are ready for immediate delivery. All are in excellent condition. Further information will be furnished on request.

50 - 220 HP Benz
50 - 200 HP Benz
50 - 160 HP Beardmore
200 - 260 HP Mercedes
65 - 160 HP Mercedes
75 - 200 HP Hall-Scott L-6

These motors are part of the largest stock of foreign built motors and spare parts in America, and are ready for immediate shipment.

Detroit
Marine Aero-Engine
Company

409 Connecticut Ave. Detroit, Mich.

OUR NEW AIRCRAFT BARGAIN SHEET

AIRPLANES

TERMS: Cash with all orders of $25.00 or less, above that amount 50% required with order, balance C.O.D.

1 new Lincoln Standard four-passenger Cabin plane equipped with 180 Hispano-Suiza motor, 56 gal. gas tank, finished in maroon enamel with gold bronze wings, double aileron, has excellent performance, doing 84.7 m.p.h. in 110 mile race at St. Joseph in October '23. Special price on this beautiful job $2750.00

1 Martin R, rebuilt and in beautiful condition, equipped with 200 HP L6 motor, carries five passengers, a BIG BARGAIN at .. $2500.00

1 Fokker D7 type rebuilt, two passenger equipped with new 150 Hispano-Suiza motor, carries 52 gal. gasoline, just refinished with New Grade A linen, six coats nitrate pigmented bronze dope. We figure this one of the most efficient and beautiful jobs in America. Won 110 mile at St. Joe, October, 1923, averaging 117.4 m.p.h Special price on this job with motor $2250.00

Without motor ..... $1600.00 Same job with new OX5's $1175.00

Several OX J-1 Standards, without motor ..... $ 950.00 Same job with overhauled OX5 motor $1075.00

We wish to impress upon your minds that these ships are all covered with new cloth, six coats pigmented silver dope, aluminum cowlings, 35 gal. gas tank and finished with the same care as the Lincoln Tourabout.

New Standard fuselage, with controls, 35 gal. gas tank, Hall Scott motor mounting ..... $ 350.00

Standard fuselage, less controls and gas tank, Hall Scott motor mounting ..... $ 225.00

Complete Standard fuselage and wings in knockdown form, including three wheel landing gear ..... $ 195.00

We have the largest stock of new Standard J-1 wood parts in the United States. Our prices are so reasonable that you cannot afford to make these up. Write us your wants. A deposit of $250 will hold any of these planes 30 days

NEW STANDARD J-1 FITTINGS

FUSELAGE

Center and rear seat rail clamps	.11
Control clevises, drop forge	.12
Control bearings	.85
Control wire pulls	.08
Control bearing back plates	.05
Engine bed cross piece sockets	1.17
Floor board clips	.10
Fitting sockets	.02
Front wing roots, fuselage	1.45
Fuselage hand grips	2.15
Instrument board clips	.06
Oval rubber guides	.10
Rear engine bed sockets	2.15
Rubber wire spreaders	.01
Rubber stick grips	.25
Sockets, longeron nose plate	.40
Strut sockets	.30
Safety belt loops	.15
Seat cross piece fittings	.18
Steel plates for engine beds	.30
Station 1, upper and lower, each	.20
Station 2, upper	.32
Station 2, lower	.48
Station 3, lower (fuselage-landing gear) pin type	1.90
Station 3, lower (fuselage-landing gear) plate type	1.80
Station 3, upper	1.70
Station 4, upper	.60
Station 4, lower	.45
Station 5, lower (fuselage landing gear, rear) pin type	1.90
Station 5, lower (fuselage landing gear, rear) plate type	1.80
Station 6, upper and lower, each	.45
Station 7, 8, 9, upper and lower, each	.40
Station 10, upper lower, each	.60
Station 11, upper and lower, each	2.15
Tank brackets	.27
Wire clips, Sta. 5, 6, 7	.02
Wire pulls, Sta. 11	.20

WING

Aileron hinges	.22
Aileron horns	.80
Cabanes	2.15
Aileron pulley link	.30
Cooper wire trailing edge clips	.02
Internal wing fittings	.40
Overhang flying fittings, No. 2888	.35
Upper wing plates, No. 5279	.20
Upper wing overhang wire pulls, No. 3084	.10
Wing hinges	1.95
Wing pins	.22
Wing hinge U's	.05
Wing skid plates, No. 5681, No. 5683	.95
Wing external fittings, No. 5132, No. 5133, No. 5528, No. 5530, No. 5531, No. 5532, each	1.05
No. 5137, No. 5138, No. 5518, No. 5519, No. 5534, No. 5536, each	.95
No. 5145, No. 5515, No. 5517, No. 5516, No. 5535, each	1.00

TAIL

Center rudder bearings	.20
Elevator bearings	.20
Elevator and rudder rib fittings	.17
Fin double wire pulls	.10
Tail skid rubber loops	.15
Tail skid rubber loop U's	.15
Upper fin bearings	.08

LANDING GEAR

Axle collars	.12
Brass axle washers	.10
Flanges for landing gear	.08
Half flanges for landing gear	.06
Landing gear pins	.05
Strut sockets, pin type	1.25
Strut sockets, plate type	1.80
Three wheel landing gear lower fittings complete with wire pulls	3.60
Three wheel landing gear spools	1.30
Two wheel landing gear lower plate fittings	4.70
Wire pulls	.18

SPECIAL BARGAIN PRICE ON COMPLETE SET STANDARD J-1 FITTINGS 87.50

LANDING GEARS

Standard J-1 Two wheel pin type complete, less wheels ..... $ 85.00

Two wheel plant type, complete, less wheels 75.00

Landing gear wood V's 17.50

New Steel type less wheels such as used on LS5 ..... 85.00

Three wheel pin type complete, less wheels 37.50

Spreader boards, each 3.75

Axle for 26x4 wheels 4.50

WINGS—STANDARD J-1

Complete set wings, two uppers and two lowers, new cloth, 6 coats pigmented silver dope 290.00

Upper wing, new cloth, new dope 90.00

Lower wing, new cloth, new dope 60.00

We do not offer wings of original linen as same is eight years old and unfit for safe flying.

AILERONS, RUDDERS, ELEVATORS, STABILIZERS—STANDARD J-1

Rudder, new cloth, new dope ..... $ 9.75

Elevators, new cloth, new dope $37.50

Aileron, new cloth, new dope 18.50

Stabilizers, new cloth, new dope 27.50

Vertical fin, new cloth, new dope 4.50

Large type balance rudder and fin, steel tubing construction such as used on LS5 complete with new cloth, new dope 47.50

INSTRUMENTS

Oil gauges, 60 lb., 120 lb.	$2.75	Altimeter, 12,000, 15,000 ft.	6.00
Gasoline gauges	3.00	Air gauges	.65
Double Dixie switches	1.90	Air hand pressure pump with or without shut-off	2.00
Heat gauges, Foxboro	11.00	Tachometer head, Johns-Manville	6.50
		Knife switch	.50
		Gas connection shut-off to carburetor	1.00

We have a complete line of gasoline shut-off pet cocks, unions, and any make of brass connections. We are selling them in any amount for 50% actual wholesale cost. Write for size and quantity wanted.

WIRE & CABLE

1/8" Roeblings Aircraft strand	per ft. 3c
5-32" Roeblings flexible cable	per ft. 4c
In 1,000 ft. lots	per ft. 3c
No. 8, 9, 10 aviator hard wire	per lb. 30c
Packard three strand ignition cable per ft.	3c

MISCELLANEOUS

Brass wire, soft 1-16" ..... per lb. 28c

AIRPLANE MATERIAL

Black shock absorber	per ft. 5c
Copper gas tank outlets	each 35c
Clevis pins	per C $1.00
Ferrules, No. 8 and No. 9	per C $1.25
Gas tanks, 35 gal.	each $9.50
Oil oak stain, 5 gal.	$5.00
Sheet aluminum, 16 and 18 ga., 4'x12'	per lb. 50c
Shelby seamless steel tubing, sizes to 1", 10c per ft., over 1"	per ft. 15c
Tape, 2 1/4" pinked	per yd. 4c
Tape, 1/2" wishbone	per yd. 2c
Thimbles, 1-16", 3-32", 1/8", 7-32"	per 100 $1.00
Turnbuckles, any size	per 100 $8.50
Wire clevis, each	7c

BOLTS, NICKEL STEEL

3-16"x3/8", 1/2", 5/8", 3/4", 1", each	.01
1/4"x3/8", 3/4", 1", 1 1/8"	.01 1/2
1/4"x3 3/4", 3 5/8", 4 1/2", 4 5/8", 4 3/4" each	.03

BOLTS

1/4" ball face x 3", 3 3/8", 3 1/2", 3 5/8", 3 3/4", each	.03
1/4" ball face x 3 7/8", 4 1/8", 4", 4 3/8", 4 1/2", 4 3/4", each	.03 1/2
Eye bolts, 5-16"x2 1/2"	.17
Eye bolts, 7-32"x1 1/2"	.08
5-16"x1", 1 1/2", 1 3/4", each	.02
5-16"x2 1/2", 2 5/8", each	.03
3/8"x1", 1 1/4", 1 1/2", each	.02
3/8"x2 1/4", each	.03
3/8"x5", each	.04

MOTORS

New 150 Hisso built here in our factory of all new parts .. $595.00

New 180 Hisso, same construction 645.00

150 Hisso, used but in first class condition ..... $400 to 500.00

180 Hisso, overhauled and in A-1 condition 575.00

220 Hisso, overhauled ready for installation 275.00

WE MAKE MOTOR EXCHANGES

Send in your Hisso and we will make an exchange for one with new bearings, new rings and in condition to do at least 150 hours at a very reasonable price. Write exact condition of your motor and we will quote prices by return mail.

If you do not find listed parts or material you need, write us. WE HAVE EVERYTHING FOR A STANDARD SHIP AND HISPANO MOTOR.

WE HAVE STOCK OF NEW CARBURETORS AND CARBURETOR PARTS. WRITE US YOUR WANTS AND WE WILL FURNISH PRICES BY RETURN MAIL.

WIRE MONEY AND ORDER BY NIGHT OR DAY LETTER AT OUR EXPENSE IF ORDER IS OVER $25.00. WE GUARANTEE SHIPMENT WILL BE IN HANDS OF EXPRESS COMPANY WITHIN ONE HOUR AFTER RECEIVING YOUR WIRE.

GET OUR LIST AND PRICES ON HISPANO MOTOR PARTS, 150, 180, 220 HP

LINCOLN STANDARD AIRCRAFT CORP. LINCOLN, NEBR.

MONUMENTAL AIRCRAFT CO.

Offices
1030 N. CALVERT ST.
BALTIMORE, MD.

Aerodrome
LOGAN FIELD
MARYLAND

WAREHOUSE: COLLEGE PARK, MD.

Announcement to all users of aircraft

We have just completed the purchase and assembly of the most complete line of JN and Canuck planes and parts; also OX-5, OXX-6; we also have other motors and parts not listed, on which we offer exceptional prices. Ask us for what you want.

The large volume of our business enables us to offer these to the public at the most attractive prices. To demonstrate this see the following extracts from our catalog:

Radiator	$12.00	Propeller Hub Puller	$ 2.00
Tires (26x4)	$ 2.50	Zenith Carburetor	$12.00
Tires, D.H.	$ 3.50	JN double aileron wings	$45.00
Shock Absorber (good live rubber) per foot	$ .12	Piston Rings	$ .15
Set of landing gear struts	$ 8.80	New Berling magnetos	$15.00
Complete set of 80 gaskets	$ 3.00	Toothpick propellers, all makes	$10.00
Booster magnetos	$ 5.00	Hisso 150 H.P. propellers	$20.00
Altimeters	$ 5.00	Tack on fuselage covers	$12.00
Spark plugs	$ .20	D.H. wheels	$ 4.00
Cylinder	$ 3.00	Complete set 20 hose	$ 1.25
Valves	$ .20		

"THE LEVIATHAN OF THE AIRCRAFT FIELD"

Aeroplane Motors

Gnome 160 H.P. new complete rotary 9 cylinder 292 pounds suitable aeroplanes, motor boats, ice sleds, wind wagons, F.O.B. Dayton, O: 15.00

(Have extended the time limit of price advance to $25.00 until May 10th.)

Le Rhone 120 H.P. (type used for making radial engines) complete 50.00

Hispano 150 H.P. complete boxed crated F.O.B. Minneapolis 750.00

Hispano 220 H.P. complete New boxed New York or Minneapolis 250.00

Hispano 220 H.P. complete slightly used 165.00

OX5 Curtiss overhauled complete boxed F.O.B. Minneapolis 125.00

WOULD YOU BUY A NEW OX5 Curtiss at $150.00 Advise.

Resistal goggles, with special pair passenger goggles clear glass 2.60.

New and used aeroplanes $650.00 up. Curtiss, Standard, Avro, Thomas Morse.

Parts, propellers, wings, dope, linen.

Marvin A. Northrop
200 Builders Exchange
Minneapolis, Minn.

WACO

Real performance in a three place ship with a stock OX-5 motor

Highest Speed
Highest Cruising Speed
Lowest Landing Speed
Best Speed Range
Quickest Take Off
Highest Angle of Climb
Lowest in Price

Steel Fuselage
Steel Empennage
Oleo Type Landing Gear
Thirty Seven Gallon Fuel Tank
Free Air Radiator

Do you want the booklet?

THE ADVANCE AIRCRAFT COMPANY
TROY, OHIO

When Writing to Advertisers, Please Mention AVIATION

FOR SEAPLANES

Many thousand gallons of Jeffry's Waterproof Liquid Marine Glue have been used by the U. S. Navy and War Department and all manufacturers of seaplanes.

L. W. Ferdinand & Co.
152 Kneeland Street
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Aircraft Gears
that are ACCURATE to 2/10,000 of an inch!

I-X-L Ground tooth spur gears are noiseless, vibrationless, safe, dependable. The logical gears for airplane use.

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The Aeroplane

Published Weekly

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CHARLES GREY
Editor

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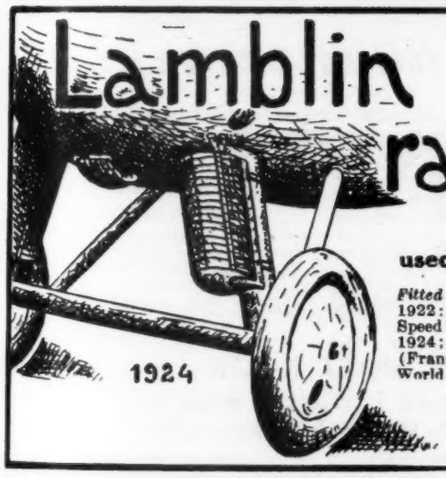
1 year—$8.50

Lamblin radiators



1922

used all over the world **on more than 10,000 aircraft**

Fitted to the winners of the following events: Gordon Bennett Cup; Deutsch Cup, 1920, 1921, 1922; Pulitzer Trophy, 1921; Circuit of Brescia; London Aerial Derby, 1922, 1923; the British Speed Record; Grand Cup of Italy, 1921, 1922; Lamblin Cup, 1923, 1924; Zenith Cup, 1923, 1924; Olympic Games Cup, Antwerp; Morane Challenge; Grand Prize of the Aero Club de l'Ouest (France); Grand Prize for Transport Planes (France), 1923, 1924; World Duration Record; World Speed over Distance Records (Airplanes and Seaplanes); World Altitude Record.

For particulars apply to

ETABLISSEMENTS LAMBLIN 36, BOULEVARD BOURDON. NEUILLY-SUR-SEINE, FRANCE

DOPES

PIGMENTED DOPES
VARNISHES ENAMELS

TITANINE

MADE BY
TITANINE, Inc.
UNION, UNION COUNTY, N. J.
Contractors to U. S. Government

PLYWOOD
Water Resistant Panels
Made According to
Government Specifications
Any Size or Thickness
New Jersey Veneer Co.
Paterson, N. J., U.S.A.

For Greater Speed and Safety

WHAT better proof of the safety and endurance of Hartshorn Streamline Tie-Rods, than the fact that the "Round-the-World" planes were completely equipped with them and that they served PERFECTLY for the entire trip!
Presenting much less surface to the wind — thereby permitting greater speed without sacrificing safety — there is nothing lacking in their performance.

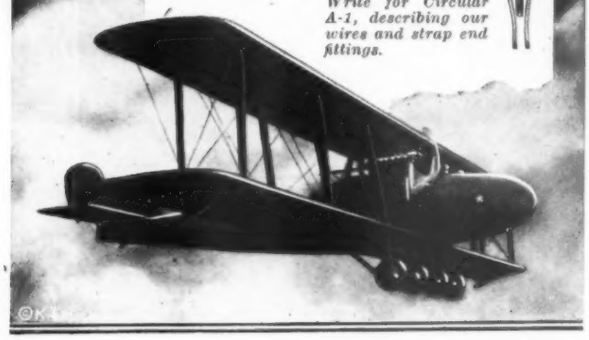
Made according to U. S. Army and Navy specifications.

Hartshorn

Est. 1860

STREAMLINE TIE-RODS

Write for Circular A-1, describing our wires and strap end fittings.



STEWART HARTSHORN CO., 250 Fifth Ave., New York

The Plane

You Have Been Waiting For

The New Travel Air Three Place OX5 Engined Commercial Airplane Designed by Lloyd Stearman.

Sworn Performance

Observed by Wichita Chapter, N.A.A. March 13, 1925:

Average Speed, One Passenger and Pilot	96 m.p.h.
With Useful Load of 1119 lbs.:	
Take off	451 ft.
Climb to 500 ft.	2 min. 3 sec.
Climb with Pilot and one Passenger, 1000 ft.	1 min. 6 sec.

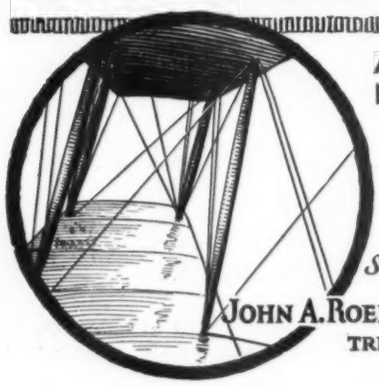
PRICE $3,500., F.O.B. WICHITA

THE TRAVEL AIR MFG. CO.

Wichita, Kansas

Address Dept. "A"

ROEBLING



AIRCRAFT PRODUCTS

WIRE CORD
STRAND
THIMBLES
FERRULES

Send for Catalog A-484

JOHN A. ROEBLING'S SONS CO.
TRENTON, N.J., U.S.A.

Announcement

LUDINGTON EXHIBITION CO., INC.

Office	*Flying Field*
810 Atlantic Bldg.	Pine Valley Flying Field
Phila., Pa.	Clementon, N. J.
Tel. Locust 7393	Tel. Laurel Springs 211

SPARE PARTS

We have acquired a large stock of Canuck parts, OX and OXX engines etc., all of which have been carefully stored under cover.

EXAMPLES

WING PANELS and DETAILS

Uppers, with fittings less aileron	$60.00
Lowers, with fittings less aileron	50.00
Wing struts	2.00

PROPELLERS

OX5, OXX2, OXX6 boxed, perfect condition	10.00
Anzani	$25.00 to $65.00

MOTORS

OX and OXX, range with condition	$40 - $250.

Fuselage, tail, landing gear, control and other assemblies.
Fabric, Dope, Varnish, Cable, Turnbuckles, Clevis Pins, Thimbles etc.

SPORT FARMANS ..... $1200 and up.

WRITE OR WIRE FOR FULL LIST

Wanted

Liberty motor assemblers who can do first class work in production without being watched. Steady work all year around. Give age, nationality and references.

BOX 342 AVIATION

THE Aircraft Service Directory

WHERE TO PROCURE EQUIPMENT AND SERVICES

Our mailing list is being revised and we shall be pleased to include your name. Please let us know if you are interested in our products as an aircraft manufacturer, designer, dealer, operator, owner or pilot.

PIONEER INSTRUMENT COMPANY

MAIN OFFICE AND FACTORY BROOKLYN NEW YORK

WASHINGTON 441 STAR BUILDING — PARIS 97 BOULEVARD SAINT MICHEL — SAN FRANCISCO 15 SPEAR STREET

NEW AND USED PLANE BARGAINS

Thick Wing Canuck (60 gallons gas), $1,450.
Canuck slightly used—Jenny slightly used A shape $950.
Hisso Motored Clipped wing, Lincoln Standard, 3 place speedster, doctor's plane, used for pleasure only. Motor just overhauled, for quick sale $1,300. One new Canuck, just assembled, two seats in front cockpit $1,550.

PARTRIDGE, INC.
3515 West 83rd Place Chicago, Ill.

ANNOUNCEMENT:

We have bought up the entire stock of many companies holding parts for the Curtiss OX5 and OXX6 motors, together with a vast quantity of parts for the Berling Magneto. We have on hand large quantities of absolutely new and overhauled motors, together with new spare parts; seven hundred new propellers, mostly toothpicks; and over one thousand new Zenith carburetors. We have a modern flying field, up-to-date machine shop and experienced mechanics for both land and water craft. We cordially invite those interested to inspect our stock, field and equipment.

Anderson Aircraft Manufacturing Co., Anderson, Indiana

TWO SPLENDID "BUYS"

One 1925 model Swallow, practically new, perfect condition $2300.00
One brand new five place Hisso Standard, beautiful job $2000.00

NICHOLAS-BEAZLEY AIRPLANE CO.
MARSHALL, MO.

WANTED: Draftsman, good layout man for metal construction, preferred. Must have aircraft experience.

HUFF, DALAND & COMPANY, INC.
OGDENSBURG, N. Y.

TRADE **HAMILTON** MARK

HISPANO PROPELLERS IN STOCK

HAMILTON AERO MANUFACTURING CO.
60 KEEFE AVE. MILWAUKEE, WIS.

WANTED:

Metal Pontoons, either duralumin or steel.
Also—Reed or other metal propeller for Liberty motor.
Also—Duralumin in tubes and in sheets.

YACKEY AIRCRAFT COMPANY
810-818 Desplaines Avenue
Forest Park, Illinois (Suburb of Chicago)

The Reed Propeller *(Patented)*
Foreign Department

In production by Licensees in principal foreign countries.
Address— S. A. REED, 113 E. 55TH., NEW YORK, N. Y.
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